The FOUNDRY

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Castings Weigh Heavy Loads To Protect the Highways

IN THE neighborhood of $1,500,000,000 is being spent annually for the construction of hard surfaced roads throughout the United States. In addition, a large sum of money is being appropriated by federal, state and county governments for the repair and maintenance of the highways. However, the vast construction program now being undertaken does not meet

Courtesy the Black & Decker Mfg. Co.
The Truck Is Driven onto the Portable Scale and Readings Are Made from the Dial

the public demands which are caused by the rapid growth of automobile travel in recent years. For that reason it is important that the cost of upkeep be kept as low as possible to permit the bulk of available funds to be devoted to new road construction. Destruction of streets and highways, especially in the vicinity of thickly populated areas, is caused largely by overloaded vehicles. To prevent this evil, many cities, counties and states have passed laws limiting the loads which may be carried by motor trucks. In regulating this type of traffic and in determining the load carried, it is necessary for the officers to have a scale for weighing the loaded trucks. The device used must be portable since many times it is necessary to weigh the loaded truck at a long distance from a platform scale. One type of scale now in use weighs 45 pounds and the officer carries a pair around in the side car of his motorcycle. This scale is constructed of heat treated aluminum alloy castings.

Find Where Castings May Be Sold.

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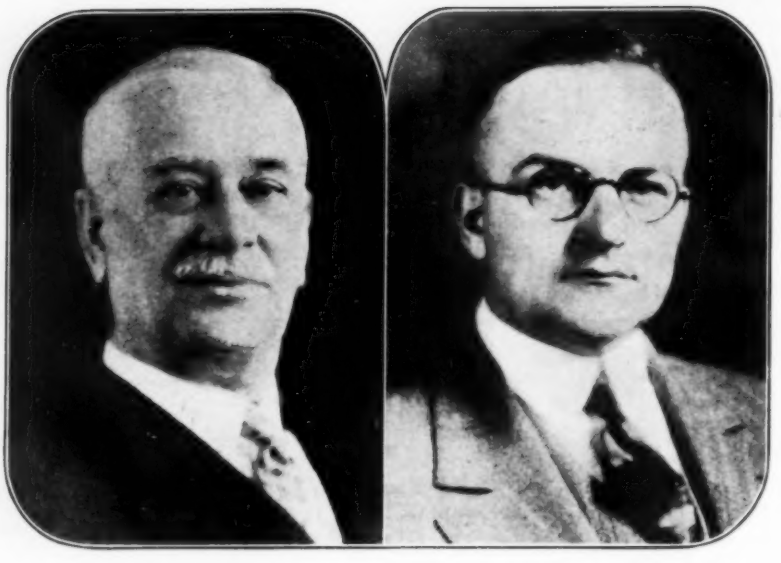


ENTIRE

Announcement was made of the election of Samuel T. Johnston as president and Fred Erb as vice president of the A. F. A at the business session. Mr. Johnston is vice president of the S. Obermayer Co. and vice president of the National Engineering Co., Chicago. Mr. Erb is president of the Erb-Joyce Foundry Co., Detroit.

A NEW era in the foundry industry of the United States was ushered in with the thirty-second annual convention of the American Foundrymen's association held in Philadelphia, May 14 to 18. For a number of years, leaders of the industry who have gathered yearly to talk over the problems of castings production, have been concerned almost solely with manufacturing processes. The desire to produce the best possible product at the lowest possible cost has been the guide to all deliberations.

Without detracting one iota from the technical work that has carried the manufacturing phase of the industry to its present advanced position, additional work of an entirely different character has been undertaken. The industry has awakened to the need for a careful study of the commercial aspects of the business. Perhaps for the first time in the history of the association, careful consideration was given to methods of selling castings. In addition to an interesting paper on the subject, an exceptionally large display of steel, malleable and gray iron castings showed clearly many of the engineering possibilities of castings.

Attendance at the technical sessions was exceptionally large and considerable discussion developed at sessions on nonferrous metals, steel founding, cast iron metallurgy, costs, malleable iron practice, management, apprentice training, sand and materials handling. An outstanding feature of the convention was the cupola course, which was held for the first time this year. The large attendance at each of the four meetings and the great interest shown in the discussion foretells the continuation of this convention activity.

Never before in the entire history of the American Foundrymen's association has that great technical society received such universal recognition from a municipality as was accorded by Philadelphia. Surrounded by the civic, industrial, and commercial leaders of the city, Mayor Harry A. Mackey at 10 o'clock Monday morning addressed the officers and leaders of the American Foundrymen's association in the beautiful reception room of the city hall, and extended to the American Foundrymen's association and to the industry which it represents the felicitations and most hearty welcome of the city. He then pressed a key, which closed an electrical connection that set in motion the machinery of the gigantic exposition of foundry equipment and supplies at the Commercial museum.

In his address, the may paid tribute to the foundry industry and the influence which it has had upon the business history of his city. He expressed the most cordial welcome of the city on the fourth occasion when the American Foundrymen's association selected Philadelphia as its convention city.

In his reply, President S. Wells Utley, expressed the appreciation of the association and its individual members for the hearty and sincere manner in which the city offered its hospitality. He spoke of the venerable antiquity of the castings art, antedating cities and perhaps all forms of social or political organization and commemorated the part which Philadelphia has played in the growth of the foundry industry in this country.

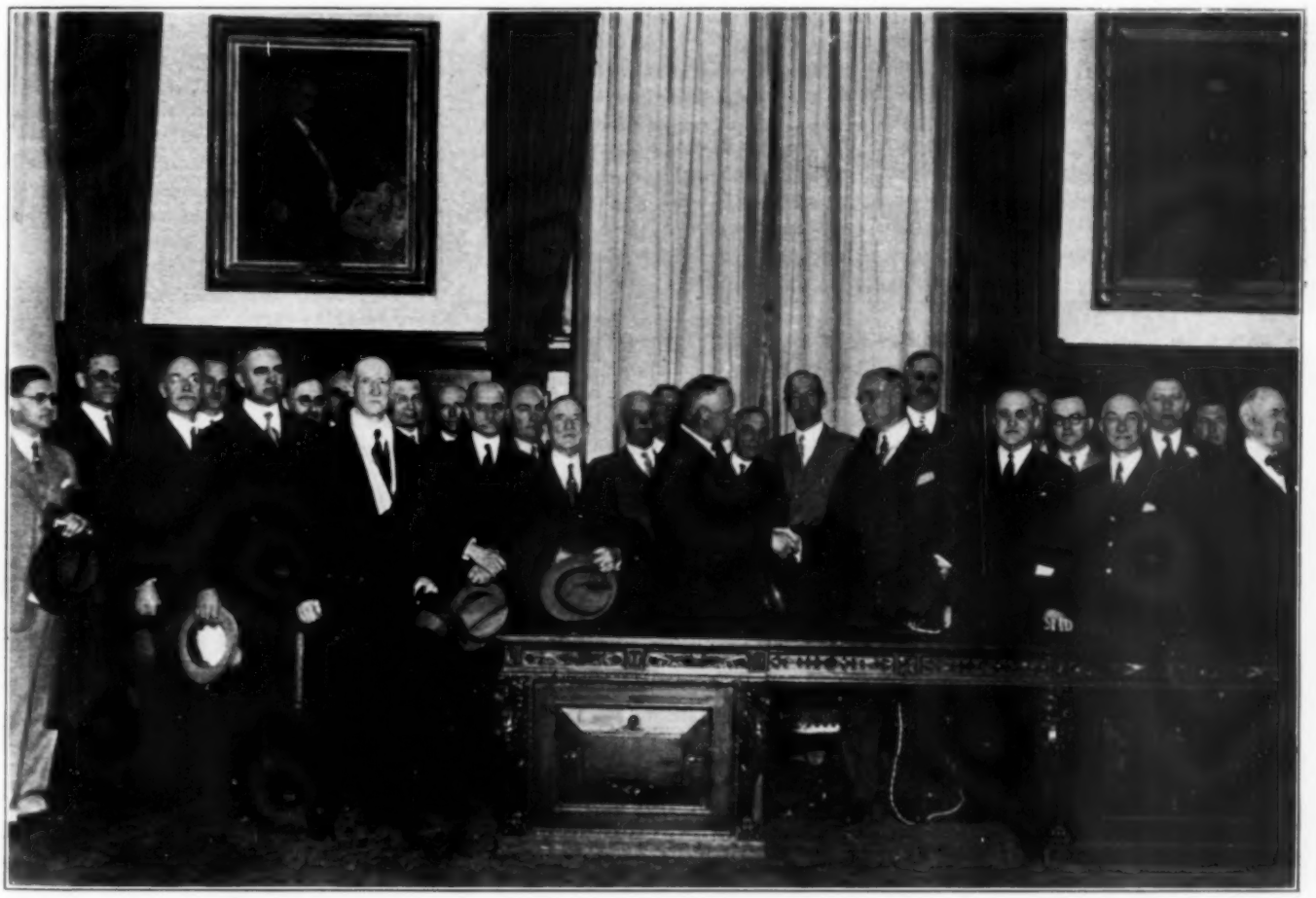
Among the prominent members of the American Foundrymen's association who were present by invitation at this formal opening were the following: S. Wells Utley, Detroit Steel Casting Co., Detroit, president of the American Foundrymen's association; S. T. Johnston, S. Obermayer Co. and National Engineering Co., Chicago, vice president of the association. The following di-

Foundry Industry Gains by A. F. A. Convention

rectors were in attendance: Fred Erb. Detroit; T. W. Pangborn, Hagerstown, Md.; N. K. B. Patch, Buffalo; V. E. Minich, New York; S. C. Vessy, Cleveland; A. E. Hageboeck, Moline Ill.; and B. H. Johnson, Philadelphia. Further a number of oldtimers, influential men of the association and former officers were present, including the following: W. H. McFadden, Ponca City, Okla.; G. H. Clamer, Ajax Metal Co., Philadelphia; Benjamin D. Fuller, Whitehead Bros Co., Cleveland; Alfred E. Howell, Somerville Stove Works, Somerville, N. J., and Dean Clifford B. Connelley, Carnegie Institute of Technology, Pittsburgh.

Dean Connelley is well known throughout Pennsylvania for his service as secretary of commerce and labor for the commonwealth a number of years ago. Mayor Mackey recalled Dean Connelley in most friendly manner, having been under the Dean's direction in that department of the state government in those years. The chamber of commerce was represented by A. M. Greenfield and also by Frank L. Devine, director of conventions and T. D. Richter, secretary of the publicity bureau.

Approximately 250 leaders of the manufacturing and foundry industry gathered Monday at 12:30 p. m. at the luncheon given by the Philadelphia chamber of commerce at the Commercial museum. Following the luncheon George Elliott, assistant secretary, Philadelphia chamber of



Mayor Mackey Welcomed A. F. A. Members at the Opening Ceremony in the City Hall

commerce introduced A. M. Greenfield, chairman of the Philadelphia Convention and Exhibition committee of the chamber of commerce who acted as toastmaster and chairman of the luncheon. In his introductory speech, Mr. Greenfield recalled Philadelphia's early part in the formation of the American Foundrymen's association in 1896, and mentioned that at that luncheon many who attended the first American Foundrymen's association convention held in that city were present. He then introduced W. Freeland Kendrick, former mayor of Philadelphia who presented the address of welcome to the American Foundrymen's association.

G. H. Clamer then was introduced by the toastmaster who in behalf of the chamber of commerce presented him with a gavel made of the flagstaff which was carried in Washington's army in 1777. This gavel was presented to Mr. Clamer in recognition for his effective work in bringing the American Foundrymen's convention to Philadelphia. Mr. Clamer expressed his appreciation for the honor accorded him and stated that his committee deserved recognition for its part in arranging for the meeting.

Mr. Geenfield then introduced S. W. Utley, president of the American Foundrymen's association, who responded to the address of welcome. He expressed appreciation in behalf of the American Foundrymen's association to the chamber of commerce and to the Philadelphia committee for the work they had done in making the convention week memorable in the history of the association.

Hold Business Session

PRESIDENTS come and go but the distinctive character of the American Foundrymen's association is an established factor which only changes by taking on added prestige and influence as the years pass by. This was the sentiment of the retiring president's speech at the opening meeting on Tuesday. It was clear from the applause and the many expressions of approval from the speakers to follow that this was the hearty sentiment of the entire association.

One speaker from across the seas, John Shaw, foundryman from England and recipient last year at Detroit, of the John A. Penton medal, voiced his enthusiasm in no uncertain terms. He said he felt the statement of the aims and characteristics of the association as presented by the president should be kept in mind by all foundrymen not only here but in other countries. We must make our products better he said and to this end we need the assistance of great associations like the American Foundrymen's association and also we should have more co-operation in research between America and England.

Committee reports were presented again this year as they were at Detroit. Plans for the Third International Foundrymen's congress to be held in June, 1929 were presented by H. Cole Estep, Penton Publishing Co., Cleveland, chairman of the international relations committee. This congress is to be held at London in co-operation with European foundrymen's associations and in conjunction with what is expected to be the largest exhibition of foundry equipment and supplies ever to be held in Europe. Mr. Estep said that not only was this of importance as an educational institution but that it held far reaching possibilities in the promotion of better understanding among the peoples of the world.

C. J. Freund, Falk Corp., Milwaukee, outlined the work of the apprentices' committee during the past year. This work, he said has been focused on group training. Many foundries are too small to adequately train men to carry on the work of the industry but by joining in small community groups the apprentices readily may receive properly diversified experience.

Dependable cost systems are absolutely essential to the proper conduct of the foundry business according to A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., chairman of the foundry cost committee, who told of the progress in educational work along this line and of the constructive work of his committee.

B. D. Fuller, Cleveland, chairman, molding sand research committee, told of a pamphlet to be issued shortly covering many important tests of molding sand. He said that his committee had furnished tentative standards on molding sand to make available as soon as possible some of the results of extensive but incomplete research work.

An opportunity to save millions of dollars rests with research workers in the field of corrosion in the opinion of H. Y. Carson, National Cast Iron Pipe & Foundry Co., Birmingham, Ala., who sent in a telegraphic report for the corrosion of metals committee.

Among other committee reports were those of A. W. Lorenz, Bucyrus Erie Co., South Milwaukee, on heat treatment, R. A. Bull, Electric Steel Founders Research group, Chicago, on phosphorus and sulphur in steel.

Exhibitors' Banquet

ABOUT three hundred manufacturers of equipment and supplies gathered at the Benjamin Franklin hotel Monday evening for the first

S. T. Johnston Elected President

SAMUEL T. JOHNSTON, president-elect of the association, has served as vice president for the past two years and has been connected with the activities of the association ever since it was organized in 1896. He was born and educated in Scotland and as a young man came to the United States where he secured a position under J. H. Whiting, at that time general superintendent of the Detroit Car Wheel Co. Later Mr. Whiting organized the Detroit Foundry Equipment Co. and engaged Mr. Johnston as salesman. The connection continued for 10 years and then he joined the force of S. Obermayer Co., Chicago, and in various capacities has remained with that company up to the present. For several years he has been vice president and general manager. Recently he also was elected vice president of the National Engineering Co., Chicago.

In his early days in the city he became identified with the Western Foundrymen's association and was elected secretary in 1896. When this association joined the Philadelphia Foundrymen's association in the movement to organize a country wide association he was one of the signers of the joint invitation sent out calling a meeting in Philadelphia in May, 1896. He is a charter member of the association and never has missed attending a convention.

When the Foundry Supply association was organized in 1906 to handle exhibits at the annual conventions, he was elected the first president. In 1908 he was made a vice president of the American Foundrymen's association. He was one of the signers of the application for a charter when the association was incorporated in 1916. He was elected one of the directors and served continuously for eight years.

annual exhibitors' dinner of the American Foundrymen's association. For a number of years it has been customary for the Foundry Equipment Manufacturers' association to hold a dinner on Monday night for its members. However, this year it was considered advisable to enlarge this affair to include all of the companies represented at the exhibition. The banquet was held under the joint auspices of the American Foundrymen's association and the Foundry Equipment Manufacturers association.

The meeting was opened by S. C. Vessy, president of the Foundry Equipment Manufacturers association, who introduced the toastmaster, S. T. Johnston, President elect of the American Foundrymen's association. Mr. Johnston in turn introduced S. Wells Utley, president of the American Foundrymen's association, who delivered the address of the evening. Short talks also were made by George Pickop, H. Cole Estep, and W. H. McFadden. Musical numbers and a vaudeville program also were provided.

Old Timers Meet

REMINISCENCES, fond recollections of days gone by, warm tributes to the notable men, and to the fine accomplishments of the American Foundrymen's association, characterized the reunion of men who attended the first American Foundrymen's association convention in Philadelphia in 1896, held in the manufacturers club Tuesday night. S. T. Johnston, who as chairman of the committee appointed by the American Foundrymen's association arranged the complimentary dinner for the old timers, presided. Mr. Johnston himself, is one of the original founders of the American Foundrymen's association and has attended every convention since that date. Following the dinner which was held at the Manufacturers' club, a new structure which replaces the building in which the founders first met, Mr. Johnston paid warm tribute to two native Philadelphians, Howard Evans and Walter Wood who were active in arranging for the first meeting. Walter Wood, when called upon, remarked upon the enormous strides which have been made in mechanical processes. He spoke of the establishment of the Philadelphia Foundrymen's association which was one of the first local organizations in the country and which assumed the responsibility of calling the first national meeting.

Howard Evans, still the youngest old timer of the group, recalled how considerations of business ethics, the question of price cutting, etc., first had inspired the idea of organizing a national association. He mentioned Dave Hanson as one man who was a strong advocate of bringing foundrymen together on national basis. Mr. Evans then sang in excellent voice the solo which he rendered in 1896, again in 1907, once more in 1919, and which those present applauded for an encore in 1948.

S. W. Utley, following Mr. Evans, remarked on a number of famous Philadelphia events which have led to accomplishments of national improvements. He spoke of the Gray-Iron institute which was to meet Friday, May 18 and remarked that Philadelphia was the birthplace of so many organizations that a social secretary was required to keep the mayor advised of national birthdays of interest to Philadelphia. Mr. Utley paid warm tribute to C. E. Hoyt secretary-manager, for his character, judgment, ability, and tireless effort which have been responsible for the success of the American Foundrymen's association in recent years.

The toastmaster then introduced John A. Penton, chairman of the board of the Penton Publishing Co. Cleveland, who was invited to make the principal address of the evening. In a reminiscent vein Mr. Penton briefly sketched the inception, the tribulations, and the growth of the paper which he first established, THE FOUNDRY, using this to introduce a fine tribute to A. O. Backert, for many years secretary of the A. F. A. and later, its president. Mr. Penton mentioned the first meeting of the A. F. A. in 1896 held in the old Manufacturers' club in response to a call sent out by the Philadelphia Foundrymen's association. He mentioned the oration by Mayor Warwick and spoke of Mr. Pfaler, Mr. Search and Mr. Schumann. He mentioned the first officers of the association of whom only Mr. Mosher, Mr. Evans and Mr. Penton had survived. He then recalled that the Philadelphia meeting had marked the beginning of two great associations, the A. F. A. and the N. F. A. and spoke of his hopes for the Gray Iron institute, stating that industries that survive must have a forward looking policy and must present vigorous measures for the future. He mentioned the wonderful developments along mechanical lines, the stupendous amount of machinery that has been brought forth for foundry use since 1896. Mr. Penton stated that other countries send men to look, to study and to profit by the progress in foundry manufacturing lines displayed through the exhibitions. Much of the advance has been due in large measure to the work of the A. F. A.

W. H. McFadden, Ponca City, Okla., a man who as a country boy went to Pittsburgh to learn the foundry trade and who was the foundry superintendent for McIntosh-Hemphill Co. at eighteen, general manager at 21, assistant to the president at 25 and in later years president of the A.F.A. was the next speaker. Mr. McFadden paid warm tribute to Mr. Hoyt, to his friend, Mr. Penton and to many of those with whom he had

Fred Erb Made Vice President

FRED ERB, president of the Erb-Joyce Foundry Co., Detroit, and elected to the office of vice president of the American Foundrymen's association for the coming year, has been connected continuously with the foundry industry since he was graduated in 1908 *from the University of Michigan, Ann Arbor, Mich., with the degree of B. S. in mechanical engineering.*

Mr. Erb started his industrial career with the Detroit Foundry Co., as a cupola hand and worked up through the shop to the position of foundry superintendent and later manager. He left this plan in 1913 *to assist in organizing the Lakeside Foundry, Detroit. Shortly afterward he accepted a position with the Elmira Foundry Co., Elmira, N. Y., but his interests in Detroit prompted his early return to that city. He was appointed superintendent of the foundry division of the Packard Motor Car Co. In* 1920 *he was advanced to the position of manager of this department from which he resigned in* 1925 *to become president of the newly organized Erb-Joyce Foundry Co.*

Mr. Erb has been a member of the Detroit Foundrymen's association for the past 18 *years and is one of its past presidents. For the past six years he has served on the board of directors of the American Foundrymen's association. He has been a member of the cost committee, committee on convention and exhibition and several other association committees.*

worked as a member and later president of the A. F. A. He spoke of his own sincere interest in the foundry industry inspired by the friendship, patronage, and almost fatherly interest of James A. Hemphill, Pittsburgh.

During the evening, many of the boys of '96 delivered short addresses upon the organization, the work, and the future of the American Foundrymen's association. Among the speakers were A. E. Barlow, Newark; F. M. Reihle, Philadelphia; W. J. Coane, Philadelphia, S. C. Vessy, Cleveland, George Matlack, Philadelphia, and C. B. Connelley, Pittsburgh.

A. F. A. Hold Banquet

WEDNESDAY night at the Bellevue Stratford hotel, more than four hundred gathered for the annual banquet at which S. Wells Utley presided. Mr. Utley in a brief address offered some pungent observations on the present day conditions in business. In 1927 the total income of the United States was greater than all of the wealth of the world preceding the signing of the Declaration of Independence. He traced the development of the individualist tendency that led to the signing of that famous document in Philadelphia in 1776. Then the trend away from the individual to the interest of the community that led to the Constitution, that Mr. Utley characterized as a business statement written by business men who insisted on decent government respecting the rights of all.

Today, the individualistic idea, safeguarded for more than a century is giving way to the community of interest, as is shown by the organization of more than 3000 trade associations, which are permitted to talk about everything but the one vital subject of obtaining a fair return for the product they sell. The Sherman act was characterized as out of date, due to the fact that large combinations of huge capitalization are proving to be the only salvation for manufacturers. The farmer may talk about co-operative marketing and may engage in this means of distributing commodities, but to speak of co-operating on castings sales is a crime. Mr. Utley believes that the principle of individual liberty can endure only if the spirit of initiative is conserved through the survival of small firms as well as large in modern business.

In introducing Past-president Carlton S. Koch, Fort Pitt Steel Casting Co., McKeesport, Pa., President Utley remarked upon the wonderful fitness of the occasion that the McFadden medal, donated by W. H. McFadden, the forceful dominating personality of the A. F. A. for many years should have been awarded to A. E. Outerbridge, Jr., the scholarly scientist. This event thus united the two great characteristics that signally represent the character of the A. F. A. membership.

Mr. Koch in a pleasing address presented the medal to Dr. George W. Outerbridge, son of the man to whom it was officially awarded. Mr. Koch affirmed the statement that A. E. Outerbridge, Jr. has been the first to apply scientifically the principle of mixing iron by analysis. He referred to his marvelous findings in metallurgical lines, to his voluminous writings.

In accepting the medal on behalf of his father who died early this year, Dr. Outerbridge spoke of the great pleasure, the renewed interest in life which the award had given Mr. Outerbridge, who then was ill and having retired from active connection with the firm of William Sellers & Co., Inc. Philadelphia, a firm with which he had been identified for forty years, had felt a lack of incentive to retain his interest.

Judge Harold B. Wells, in humorous and rapid fire philosophy closed the speakers' list. After the banquet a complimentary dance was given by the Philadelphia committee.

Entertainment Provided

SPECIAL entertainment was provided the convention visitors by committees of the Philadelphia Foundrymen's association. Ladies attending the convention were taken for a sightseeing trip around the city on Tuesday afternoon and on Thursday they were tendered a fine luncheon at the Devon Park Inn and taken to Valley Forge.

A reception and dance was held in the Bellevue-Stratford hotel following the annual banquet on Wednesday evening. Special arrangements were made for convention visitors to play golf at a number of the best courses in and around the city.

Social functions in connection with the convention and exhibition closed on Thursday night with an entertainment and dance at the Scottish Rite masonic temple, Race and Broad streets. This recently completed building takes the place of one owned by the same association and which dated back to the early days of Philadelphia. Entertainment in the auditorium was supplied by prominent actors and actresses appearing on the stages of several theaters in the city. After the vaudeville entertainment, members and guests were taken to the ball room on the seventh floor where an excellent orchestra provided music for dancing.

Consider Many Steel Problems

ABOUT 60 steel foundrymen and metallurgists participated in a lively discussion on steel metallurgy Tuesday morning. Owing to the absence of W. J. Nugent, Nugent Steel Castings Co., Chicago, William J. Corbett, secretary-manager, Steel Founders' Society of America, Pittsburgh, acted as chairman. H. P. Evans presented a paper entitled "Manganese Steel," in collaboration with A. F. Burtt. Both men are associated with the Pettibone-Mulliken Co., Chicago. The paper was discussed by David Evans, Chicago Steel Foundry Co., Chicago; S. P. Rockwell, Stanley P. Rockwell Co., New York; Ralph West, West Steel Castings Co., Cleveland; and A. W. Lorenz, Bucyrus-Erie Co., South Milwaukee, Wis.

J. W. Frank, chief metallurgist, Chicago Steel Foundry Co., Chicago, presented an interesting paper on "General Characteristics of Alloy Steel Castings." S. R. Robinson, Industrial-Brown Hoist Co., Bay City, Mich.; A. W. Lorenz, S. P. Rockwell, R. A. Bull, Steel Founders' Research group, Chicago; and Mr. Jones, Lebanon Steel Foundry, Lebanon, Pa., discussed this paper.

A. W. Lorenz described a new heat treating plant built by his firm. Questions relating to various points in the lecture were asked by S. R. Robinson, S. P. Rockwell, Mr. Jones, H. P. Evans, and E. R. Young, Detroit Steel Casting Co., Detroit.

The research laboratory recently built by the American Steel Foundries, East Chicago, Ind., was described in a paper by W. C. Hamilton, research director of that company. Due to the absence of the author the paper was presented by F. A. Lorenz Jr., works manager of the East Chicago plant.

A. W. Lorenz, presented the report

of the American Foundrymen's association committee on the heat treatment of ferrous castings, of which he is chairman. The committee recommends that steel foundry members of the association read the recommendations published by the American Society for Steel Treating on the subject of annealing steel, and present any criticisms they may have to J. E. Donneilon, secretary of the recommended practices committee of the American Society for Steel Treating.

Cutting Steel Risers

Keen interest was displayed at the second session on steel founding which was held Wednesday morning, at which J. Fletcher Harper, Allis-Chalmers Mfg. Co., Milwaukee, was chairman. The first paper was presented by G. O. Carter, Linde Air Products Co., New York, on the economical removal of risers from steel castings by oxy-acetylene cutting. S. R. Robinson, Industrial-Brown Hoist Co., Bay City, Mich., and N. R. Knox, Bucyrus-Erie Co., South Milwaukee, Wis., discussed the subject.

Owing to the absence of F. A. Melmoth, Thos. Firth & Sons, Sheffield, England, his paper on "Variables in Steel Foundry Practice" was presented in abstract form by George Batty, Steel Castings Development bureau, Philadelphia. Discussion of the paper hinged on the use of aluminum in steel castings. The opinion seemed to prevail that small amounts of aluminum are necessary to obtain perfect small steel castings in green sand. Larger castings or those poured in dry molds do not need aluminum if the metal is melted properly. Those entering the discussion included Maj. R. A. Bull, Electric Steel Founders' Research group, Chicago; S. R. Robinson, A. W. Lorenz, Mr. Griffiths, Union Carbide Research laboratory, Long Island City, N. Y.; F. A. Lorenz Jr., American Steel Foundries, East Chicago, Ind.; F. J. Blaine, General Alloys Co., and L. W. Spring, Crane Co., Chicago.

Following this discussion, A. H. Jameson, Deemer Steel Castings Co., New Castle, Del., presented the report of the A. F. A. committee on steel castings. Mr. Jameson is chairman of this committee.

Reports on Tests

W. J. Corbett, Steel Founders' Society of America, Pittsburgh, presided at the steel session Wednesday afternoon. H. A. Mason, Gould Coupler Co., Depew, N. Y., read a paper on "Reducing New Sand Consumption." Mr. Mason described the experimental unit used before the work was done on a commercial scale, and then described the results obtained from the system put into use at his plant. Questions relating to the paper were propounded by N. T. Booth, Deemer Steel Casting Co., New Castle, Del.; E. R. Young, Detroit Steel Casting Co., Detroit; David Evans, Chicago Steel Foundry Co., Chicago; R. S. Munson, Atlantic Steel Castings Co., Chester, Pa.; M. D. Pugh, W. S. Tyler Co., Cleveland, and Mr. Preston, J. H. Herron Co., Cleveland.

Co-operation Is Essential

K. V. Wheeler, Lebanon Steel Foundry, Lebanon, Pa., read a paper on "Interdependence of Operating and Sales Departments in the Success of a Steel Foundry." Mr. Wheeler outlined various factors showing the necessity of co-operation between the two departments so that a profit may be shown by the foundry.

The report of the A. F. A. representative on the joint committee on the effect of sulphur and phosphorus on steel was presented by R. A. Bull, Electric Steel Founders' Research group, Chicago, who is acting in that capacity. Mr. Bull stated that the test pieces had been made for the tests, but as yet no reports are available on the various physical tests. Owing to the large number of tests to be carried out, no official report will be ready for another year.

Cupola Course Draws Interest

POPULARITY of a series of four sessions on cupola theory and operation was evidenced by the large attendance at the first meeting held Monday afternoon at which Dr. Moldenke presided in the combined capacity of chairman, speaker and answer bureau to the numerous questions presented. Suggestions and requests from various members of the association over an extended period crystallized at this convention into this form of disseminating a comprehensive survey of the subject.

For convenience the subject was divided into four sections. Dr. Moldenke discussed the principles underlying cupola operation. E. J. Lowry conducted the second session on Tuesday devoted to cupola operation. On Wednesday, David McLain, Milwaukee, described cupola charging practice, and on Thursday, H. W. Dietert, Detroit, covered cupola improvements.

With the aid of two large colored drawings suspended on the wall Dr. Moldenke explained the generation of heat and its application to melting iron in the cupola. The first drawing showed a type of gas producer the speaker saw recently in Germany. The sectional view showed in graphic form the various zones of heat ranging from 2000 degrees Fahr., near the bottom to an estimated maximum of 3900 degrees at a point considerably above the center and then to a gradually diminishing point of 1000 degrees at the outlet near the top. The analogy was pointed out to a somewhat similar row of zones in the cupola.

Importance of a uniform supply of air and the absolute necessity of uniform charging was emphasized. The ideal volume of air was given as 8.7 pounds of air per square inch of cupola cross section. The speaker dwelt on the evils of low bed in oxidizing the iron. With other conditions favorable, iron should appear in the tap hole 8 minutes after the blower is started. He also pointed out the charge should be allowed to heat up before the blast is applied. Mechanical charging to be effective must be done in a way to maintain the charge level throughout. He also emphasized the necessity of using good materials. Replying to a question, he claimed that charging oil through the tuyeres causes oxidation. Its proper function is for preheating the stock at a point above the melting zone. In one instance a saving of 25 per cent had been effected in the volume of coke by adopting this method.

The second session on cupola operation was held Tuesday under the chairmanship of E. J. Lowry, Detroit. This particular session attended by 400 members, was devoted to constructional details and a study of the effect of the various items on proper operation of the cupola.

Opening the meeting the chairman outlined the main parts of the cupola, wind pipe, wind box, tuyeres, height, style of lining and charging doors. From the discussion which followed it was apparent that a wide divergence of opinion still prevails in regard to many of these features. In a general summing up, the chair-

man admitted that while the practice of cupola melting and cupola construction has been standardized to a considerable extent theoretically, still concessions and minor adaptations are necessary in nearly all installations. The size and shape of the tuyeres are relatively unimportant so long as a sufficient volume of air is driven through them.

Among the factors which interfere with proper melting are small wind pipes and pipes containing abrupt turns. As a general rule the diameter of the wind pipe is about one-third the diameter of the cupola. According to David McLain, Milwaukee, the relation between tuyere area and cupola cross sectional area changes with the diameter of the cupola. Thus he advocates an area of 3.5 to 1 for cupolas up to 48 inches inside diameter while on a 72-inch diameter cupola the ratio is only 7 to 1.

The third session of the cupola operation course, under the chairmanship of David McLain, held the close attention of approximately 400 men for two hours. An outline of the principal features essential to cupola operation by Mr. McLain brought out a lively discussion on the proper height of the bed, blast pressure and volume, size of the tuyeres and ratio to cross sectional area of the cupola, preheating the charge, ratio of coke to iron on the bed and between the charges, relative merits of by-product and beehive coke. The session closed after many members had submitted reasons for some mysterious casting losses which two members had experienced and for which they desired a solution.

Members taking part in the discussion included Dr. Moldenke, Watchung, N. J.; Robert Crawford, Atlas Foundry Co., Detroit; L. L. Anthes, Anthes Foundry Co., Toronto, Ont., and Winnipeg, Man.; J. T. McKenzie, American Cast Iron Pipe Co., Birmingham, Ala.; Oliver Smalley, New York; K. Viall, Griffin Wheel Co., Chicago; E. J. Lowry, Detroit; Paul Ramp, Newport News Shipbuilding & Drydock Co., Newport News, Va.; C. J. Scullin, St. Louis Gas & Coke Corp., St. Louis; George Evans, Matheson Alkali Co., New York.

Dr. Moldenke mentioned a series of experiments he had conducted during the World's fair in St. Louis, 1904, to determine the relative merits of various types of coke for foundry use. This work was conducted under government auspices and the findings were incorporated in Bulletin No. 54, bureau of mines, Washington. Attention was directed to the fact that not all coke, either beehive or by-product, is perfect, and that in recent years a large number of foundries have adopted the use of by-product coke.

Hot Blast Cupola

The last session of the cupola operation course was conducted by K. Viall, Griffin Wheel Co., Chicago, and C. J. Scullin, with H. W. Dietert, chairman. Following an introductory description of the theory and practice of chilling cast iron and the process of combustion in the cupola, Mr. Viall explained the action of the hot blast cupola as originally developed in Germany and later adapted by the Griffin Wheel Co. A full description of the construction and operation of one of these cupolas was published in the Sept. 15, 1926, issue of THE FOUNDRY.

In reply to questions Mr. Viall stated that in some of the plants a saving of $100 per day or more is effected in coke consumption. On a 72-inch cupola the iron charge is 12,000 pounds with a 10-inch split of coke between. The weight of the coke between charges averages 160 pounds per ton of metal. Answering a question whether the method is applicable to cupolas running short heats, he stated that the hot blast is available almost immediately after the cupola goes in blast. The heat of the blast ranges between 400 and 800 degrees Fahr. The essential difference between the original and the new type of cupola is that cast iron pipes have been substituted for refractories in the preheating chamber. Since up to the present none of these pipes has failed, no estimate can be given on their probable length of service.

C. J. Scullin described remarkable results achieved in the melting practice of the Maytag Co., Newton, Iowa. Confirming his statement that usually too much coke is burned in cupolas, he said that the Maytag cupolas are lined to 48 inches and boshed to 40 inches. The charge is 2000 pounds with 130 pounds of coke between charges. Each cupola is in blast for 8 hours and in that time melts 108 tons of iron. A high grade coke is used and all the sprues and gates are charged while still hot.

Suggests Uniform Cost Systems

DESPITE endeavors extending over many years, cost accounting methods among foundries still are far from what they should be according to speakers at the cost accounting session held Tuesday. A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., presided, and told of tests carried on with 25 foundries to determine uniform cost methods. On one specific piece of work the quoted prices varied from $14 a ton to $27 a ton with the actual cost determined by a regular run as $20 a ton. One of the chief sources of this variation, said the chairman, is the cost of molding labor. He said that next year he expected to see a subcommittee on standardization of molding costs.

W. J. Corbett Steel Founders Society of America, Pittsburgh, presented the report of the subcommittee on foundry costs, which included four definite recommendations. These are that the cost accounting systems of the Steel Founders Society of America and of the Malleable Iron institute be adopted as official, that the same be done for the system which may be adopted by the newly formed Gray Iron institute and that a committee be organized to develop a system for the nonferrous group. John L. Carter, Barlow Foundry Inc., New ark, N. J., moved that this report be referred to the board of directors with the approval of the cost session. This was seconded by R. W. Jones, Union Switch & Signal Co., Swissvale, Pa. and carried.

J. J. Evans, Geo. H. Smith Steel Casting Co., Milwaukee, aroused discussion with a paper on "The Fallacy of Quoting and Figuring Costs on a Weight Schedule Basis." S. R. Robinson, Industrial Brown-Hoist Co., Bay City, Mich., asked about the attitude of the consumer toward the new method of quoting which Mr. Evans described. Considerable education will be needed in this direction said Mr. Evans.

Mr. Corbett explained the difficulty of adapting this method to large foundries, particularly steel foundries. When questioned on this he said that the difficulty was with the consumers. Several others, including A. C. Portor, foundry superintendent, Cushman Motor Works, Lincoln, Neb., spoke of the difficulty of convincing consumers that the individual castings price quotation is to their advantage. One foundryman, R. W. Jones, said his foundry had switched over 100 per cent to the method of quoting on the individual piece rather than on a weight basis and that consumers

and foundry alike favored the change. D. C. Finn, National Foundry & Furnace Repair Co., Dayton, O., pointed out that the piece price basis tends to eliminate unfair and misleading comparisons.

An outstanding paper on the subject of "Castings Publicity" was presented by A. F. Jensen, president, Hanna Engineering Works, Chicago. He started by quoting figures from *Daily Metal Trade*, Cleveland, to show that gray iron castings have suffered a marked decrease on a per capita basis while steel and malleable have shown increases in production per capita. He said that at a recent convention of a prominent engineering society a strenuous attack was made on castings and not one word of defense was spoken by any of the supposedly well-informed men present. The public will not continue to buy what it is not continually reminded of regardless of merit according to Mr. Jensen. He stated that there should be a well organized publicity program for the gray iron interests and also a research group to develop new uses and new markets. In support he cited the case of the sheet iron interests which have expended as much as $281,000 a year on publicity, with satisfactory results. At the conclusion of this paper slides were shown to illustrate the educational work of other groups such as the gas industry, the leather industry and the ice manufacturers in increasing the market for their respective products.

It is easy to reduce the selling price of a casting $20 a ton in competition but mighty hard to reduce the cost of producing that casting by as much as $5 a ton according to W. J. Corbett, who gave an interesting resume of the lengthy paper on cost finding practice for steel foundries which had been submitted in printed form by the cost committee. Other points in this summary included the fact that low prices do not stimulate the buying of castings and the recommendation that foundries adjust their sales schedules to make a profit when operating at 60 per cent of capacity, a figure which must be recognized as normal in the industry at the present time. After determining the cost the report advises the addition of 20 per cent to cover profit and contingencies.

John L. Carter, discussing this report, said that he felt groups in various localities should be formed to insure uniformity of cost accounting methods. These same groups he said could well consider the matter of quoting on individual castings as advocated by Mr. Hageboeck.

Studies Malleable Problems

APPROXIMATELY 100 representatives of leading producers of malleable castings in the United States were represented at the session on malleable iron founding Wednesday morning. Discussion applied principally to methods of increasing production and decreasing scrap loss, the need for research work and oxidation phenomena during the annealing of malleable castings.

R. A. Greene, Ohio Brass Co., Mansfield, Ohio, said that unusual results had been obtained in the shop of that company by appealing to the inborn instinct toward gaming and, as Mr. Greene described it, production of malleable castings at the Mansfield plant takes on many of the aspects of a game. Careful watch is kept of each man's production, and results are posted daily, showing production, loss by scrap, and the percentage of loss chargeable against the molders. The competition set up by this method of keeping a record of results has resulted in cutting castings loss from an average of more than 9 per cent to less than 5 per cent.

William M. Marr, Ohio Brass Co., who discussed Mr. Greene's paper stressed the attention which is paid by the officials of that company to the best methods of maintaining a proper mental attitude on the part of the employes. Every Saturday morning a meeting is held at the plant to discuss remedies for castings loss, and care is exercised to refrain from placing blame on anybody because, said Mr. Marr, "you cannot expect a man to show much in the way of initiative if you put him on the defensive."

In answer to questions Mr. Greene and Mr. Marr explained that the only bonus which is paid for cutting down scrap loss goes to the instructors who are in charge of the molders; that if one molder cannot make a casting satisfactorily, the pattern is given to another; that loss in cracked castings is charged against the foundry; that the instructors are held accountable for loss by cracking due to careless breaking of the gates; and that dislodged sand causes the greater amount of the scrap loss.

Those who took a part in the discussion of Mr. Greene's paper included Robert E. Belt, Malleable Iron Research institute, Cleveland, W. C. Missimer, Erie Malleable Iron Co., Erie, Pa., David McIntosh, Newark Malleable Iron Co., L. C. Wilson, Federal Malleable Co., Milwaukee, and James H. Lansing, Danville Malleable Iron Co., Danville, Ill.

The paper by R. J. Teetor, the Cadillac Malleable Iron Co., Cadillac, Mich., entitled "An Incentive Bonus Plan for Molders Based on Scrap Control," told of a bonus plan which has been used by his company for two and a half years and which has proven successful in providing an incentive in two directions, one, by encouraging the molders to work continuously and to obtain high production and the other by encouraging a low castings loss. Regular pay is based on a normal day's work and the molder is given double the regular rate for everything over the normal day's work. The bonus for production of scrap loss starts at 90 per cent and a molder having good castings to the extent to 90 to 91 per cent of his heat, gets a bonus of 10 per cent of his pay and this percentage increases to 28 per cent for 99 to 100 good castings. The company finds that it pays on the average 8 per cent more than the regular pay because of greater production and the molders on the average draw a bonus of 10 per cent for scrap loss reduction.

Robert E. Belt, in discussing Mr. Teetor's paper thought that the incentive to cut scrap loss was far more important than the incentive to increase production. He directed attention particularly to that feature of the Cadillac system whereby the increased production is obtained at a higher price per piece. In answering this objection Mr. Teetor explained that in the first place his foundry has a limited amount of floor space and that the system aims to get the greatest amount of production out of the men and to encourage the men to work continuously day after day without any layoffs. He said that the molding cost at this plant is 11 per cent of the total cost of the castings and that the increased cost for castings in excess of the normal amount of work is made up ten times over by indirect savings in other parts of the plant.

John W. Collins, United States Aluminum Co., Detroit, said that his

company has been paying bonuses to its employes for the past 16 years. This company uses the so-called Parker system. Base rates are fixed with the aid of a stop watch in determining normal production and bonuses are paid for all excess performance.

Oxidation phenomena during annealing process are important because of their relation to machine ability said H. A. Schwartz, National Malleable & Steel Casting Co., Cleveland. Mr. Schwartz stated that his paper contained no original data but constituted an attempt to correlate the results of various research workers with commercial annealing conditions, and to outline what may be expected to happen under various circumstances as to composition of furnace gases and temperature. Mr. Schwartz's paper was discussed by W. R. Bean, Grindle Fuel Equipment Co., Harvey, Ill., E. E. Griest, Chicago Railway Equipment Co., Chicago, W. C. Missimer, and others. The difficulty of conducting annealing operations in sealed pots, due to passage of gases through brick and metals was discussed.

Need for research work in foundries was discussed in a paper submitted by E. E. Griest. He told of many instances where research work on the part of the practical men has increased production, eliminated wastage of cores, reduced scrap loss, etc. W. C. Missimer, in discussing Mr. Griest's paper, stressed the importance of securing close co-operation between those engaged in research work and those in active production work, saying that all too often there is a gap between the two.

Talk Malleable Problems

Exceptional interest in malleable iron metallurgical problems was displayed at the luncheon meeting Thursday noon, at which F. L. Wolf, Ohio Brass Co., Mansfield, O., presided. Questions discussed at the meeting were selected from a previously prepared list of 40 important problems in that branch of the casting industry. In discussing methods of measuring shrinkage of malleable iron, it was stated that no exact method had been devised. One company has been experimenting with the use of a sphere in measuring shrinkage, and while the results are better than those secured with the cube, it has not been possible to correlate the results to determine their value.

In discussing the effect of chromium in malleable iron, it was stated that chromium up to 0.10 per cent does not cause a great amount of trouble. However, as the chromium content increases, the time given to cooling in the anneal should be lengthened. The effect of galvanizing malleable iron was discussed at length. With ordinarily annealed malleable iron, it was stated that a black fracture will result from heating the casting to 1250 or 1275 degrees and quenching. Embrittlement is much less likely to occur if the silicon and phosphorus are low. One foundryman stated that his company heat treats all malleable castings since it seems to iron out all irregularities and produce a more uniform product. The cost of the heat treatment depends on the type of castings. An average cost, including overhead, is ¼-cent per pound.

Some disagreement arose over the accuracy of carbon determinations. Several felt that it is exceedingly difficult to make carbon determinations and that a double determination should be made. Others felt that determinations properly made are exceedingly accurate.

The subject of pulverized coal developed considerable interest. It was stated that ideas on the fineness of the coal required for proper combustion rapidly are changing, and that proper mixing of the air in the burner is of greater importance. Generally it is considered better to have all of the pulverized coal pass through a 50 mesh screen than to have 85 per cent pass through a 200 mesh screen. It was mentioned that as the fineness increases, the wear on the pulverizing equipment and the horsepower consumed also increases. However, it was pointed out that finer coal is required in annealing than in pulverizing.

From the number of foundrymen taking part in a discussion of cutting the time of annealing of malleable castings, it was apparent that this subject is of vital importance to the industry. It was explained that one plant successfully has cut the time of annealing by allowing ample flue space between the annealing pots so that the heat is distributed uniformly. However, a word of caution was given to the foundrymen cutting the time of anneal without taking into consideration the approximately 38 variable conditions encountered. It was stated that such action, without proper understanding of the results, injures the industry.

Discuss Duplex Process

Some interesting figures were given on a duplex process recently placed in operation. The cupola charge consists of steel 30 per cent; sprue and scrap 50 per cent and pig iron 30 per cent. The coke ratio is 1 to 13 and the iron at the spout is from 2480 to 250 degrees Fahr. The metal is tapped every four minutes with each of the four cupolas melting 19 tons an hour. Three tons of iron is taken from the electric furnace at one time and three tons added. If the carbon in the iron in the electric furnace is high, steel is added up to from 4 to 6 per cent. The electric furnace holds 9 tons, and consumes from 90 to 98 kilowatts a ton. Metal is tapped from the electric furnace at 2800 degrees Fahr. The analysis of the metal is as follows: Silicon 1.00 per cent; manganese 0.38 per cent; sulphur 0.09. A desulphurizer is added to bring the sulphur to 0.068 or 0.072. With a continuous type annealing oven, the cycle is 92 hours with the maximum temperature from 1690 to 1720.

Reviews Cast Iron Metallurgy

SEVERAL important features connected with cast iron founding were discussed in three papers presented at the cast iron sessions held Tuesday under the chairmanship of R. F. Harrington, metallurgist, Hunt-Spiller Mfg. Co., Boston.

Under the heading "Automatic Blast Gate Control for Cupola Melting," H. V. Crawford, General Electric Co., Schenectady, N. Y., outlined the principal features essential for operating a cupola at highest efficiency. He also pointed out many of the errors into which cupola men fall. In a general summary he claimed that since the best results in the melting operation depend on having the weight of air, iron and coke under complete control, the next step is to introduce an apparatus and a method of controlling the weight of air supplied the cupola.

The concluding part of Mr. Crawford's paper covered a description of mechanism developed by his company designed to control the flow and volume of air automatically. He claimed that practical results over an operating period of 8 months have proved the full worth of the equipment.

"Theory of Cupola Operation in Relation to Practice" was the subject of the paper presented by R. B. Schall, metallurgist, Roberts & Manders Stove Co., Hatboro, Pa. The speaker described in considerable detail the chemical reactions that take place when the oxygen of the air unites with the carbon of the fuel and how this reaction affects the iron both from temperature and physical properties viewpoints. Where the bed is not sufficiently high and where it is not renewed properly the iron is oxidized. An abnormally high bed retards the melting speed.

The third paper entitled "Cupola Refractories," presented by C. E. Bales, Ironton Fire Brick Co., described the action of descending stock on the fire brick lining of the cupola.

Under the title "Some Recent Developments in Cupola Metal," J. D. Miller, Cresson-Morris Co., Philadelphia, presented a paper at the Wednesday morning sessions outlining the work leading up to the present practice of producing gray iron castings with a tensile strength of 60,000 pounds per square inch, a dense fine structure, absence of segregation, great wear resistance and at the same time easy machinability. These qualities are secured by the addition of nickel and by maintaining a nice balance between the carbon and silicon contents of the metal. Steel scrap is added to the charge in amounts up to 40 per cent for castings of heavy section.

Annual exchange paper of the Association de Technique de Fonderie de France entitled "Study of the Use of a Hardening Test for Cast Iron with Medium Silicon Content," prepared by M. Dudouet, foundry manager Societe Metallurgique de Normandie, Paris, was presented in the author's absence by W. F. Rauther, Buffalo Foundry & Machine Co., Buffalo. The author instanced the work already done along certain lines by M. H. Forichon and then outlined some of his own experiments to determine the circumstances in which this form of testing the metal may be used in the shop. The primary object is to enable one to determine the percentage of one or more constituents merely by examining the test piece.

In the discussion which followed John Shaw, England, claimed that the type of test described in the paper was too elaborate for practice routine foundry practice. He favors a simple test which can be accomplished rapidly and which gives approximately all the information needed by the man directing the pouring of the iron. The test piece takes two forms. One for medium and high silicon irons and the other for chill irons, particularly for iron poured into rolls.

The first is a wedge shaped piece 2 x 4 inches on top, 6 inches long and tapered to a wedge edge at the bottom. After this test has cooled beyond the critical point it is broken longitudinally and the practical man by examining the fracture readily can determine the suitability of the iron for any specified purpose. The second test block is made in a rectangular core and placed on an iron plate. When this test piece is broken the depth of chill is noted. Allowance is made for the variation between the chill shown in this comparatively small body of iron and that which will obtain in the desired casting and if necessary a small quantity of a softer iron may be added to the ladle before the casting is poured.

A paper on the "Influence of Carbon and Silicon Variations in Gray Cast Iron," prepared by D. G. Anderson and G. R. Bessmer, Western Electric Co., Chicago, was presented by D. G. Anderson. He directed attention to the fact that although improved properties are attained in cast iron through the reduction of carbon, this reduction must be regulated with caution. In practice he has found that the greatest strength is found in iron with a silicon content of approximately 2.00 per cent. He also pointed out that unless the combined foundry practice is conducted properly, the work of the metallurgist is of little avail in securing the desired metal.

Roll Call at Old Timers Dinner

Fred Frazer,
Frazer & Jones Co.,
Syracuse, N. Y.

Martin W. Henley,
Frazer & Jones Co.,
Syracuse, N. Y.

S. C. Vessy,
The W. W. Sly Mfg. Co.,
Cleveland.

L. C. Wilson,
Federal Malleable Co.,
Milwaukee.

N. K. B. Patch,
Lumen Bearing Co.,
Buffalo.

G. H. Clamer,
Ajax Metal Co.,
Philadelphia.

Clarke P. Pond,
David Lupton's Sons Co.,
Philadelphia.

Vern E. Minich,
American Foundry Equip. Co.
New York.

Bartlett M. Shaw,
Walker & Pratt Mfg. Co.,
Watertown, Mass.

Geo. W. French,
J. J. Mohr & Sons,
Philadelphia.

C. E. Hoyt,
American Foundrymen's association,
Chicago.

Geo. T. Johnson,
Geo. T. Johnson & Co.,
Philadelphia.

Alfred E. Howell,
Sommerville Stone Works,
Somerville, N. J.

Wm. J. Coane,
Ajax Metal Co.,
Philadelphia.

William J. Devlin,
Philadelphia.

Harry Drinkhouse,
Philadelphia.

Arthur E. Barlow,
Barlow Foundry Inc.,
Newark, N. J.

C. B. Connelley,
Carnegie Institute,
Pittsburgh.

L. L. Anthes,
Anthes Foundry Ltd.,
Toronto, Ont., Canada.

Geo. C. Davies,
Pilling Company, Inc.,
Philadelphia.

J. M. Danke,
General Electric Co.,
Lynn, Mass.

F. A. Riehle,
Riehle Bros. Testing Machine,
Philadelphia.

C. L. Tittle,
Blairsville, Pa.

John A. Logan,
Atlas Steel Casting Co.,
Buffalo.

S. D. Sleeth,
Westinghouse Air Brake Co.,
Wilmerding, Pa.

H. M. Lane,
The H. M. Lane Co.,
Detroit.

John Hill,
The Hill & Griffith Co.,
Cincinnati.

J. S. McCormick,
J. S. McCormick Co.,
Pittsburgh.

Benj. D. Fuller,
Whitehead Bros. Co.,
Cleveland.

Fred Erb,
Erb Joyce Foundry Co.,
Detroit.

E. H. Ballard,
General Electric Co.,
Lynn, Mass.

George F. Pettinos,
Philadelphia.

Geo. F. Stibgen,
The Malleable Casting Co.,
Marietta, Pa.

H. R. Valentine,
M. D. Valentine & Bro. Co.,
Woodbridge, N. J.

S. H. Gray,
James S. Stirling,
Wilmington, Del.

Harry F. Rebmann,
7101 McCallen St., Mt. Airy, Pa.

Geo. C. Matlack,
The Wellington,
Philadelphia.

W. H. McFadden,
Ponca City, Okla.

John A. Penton,
Penton Publishing Co.,
Cleveland.

Howard Evans,
Philadelphia.

S. T. Johnston,
S. Obermayer Co.,
National Engineering Co., Chicago.

Walter Wood,
R. D. Wood & Co.,
Philadelphia.

S. W. Utley,
Detroit Steel Casting Co.,
Detroit.

Dan M. Avey,
The Foundry,
Cleveland.

In the discussion which followed James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, directed attention to several peculiar features in the charts which accompanied the paper, some of them apparently contradictory, and which indicated that variables of all kinds must be taken into consideration in drawing conclusions.

Henry Kohlne, Superior Casting Co., Dayton, O., stated that in his practice he had found it advisable in many instances to place bosses and other heavy projections of a casting in the cope instead of in the drag, which is the generally accepted practice. By gating the casting at the comparatively thin section at the bottom he had secured better results.

In a paper entitled "Heat Losses from a 75-ton Hot Metal Car," Wm. F. Roeser, consulting physicist, bureau of standards, Washington, described an interesting series of experiments conducted on a special car designed to convey hot metal from the blast furnace to the open hearth or mixer. In a filled car of the type described the cooling rate of the metal after the first few hours was found to be about 6 degrees Cent. This seems to indicate that metal tapped from a blast furnace at approximately 1500 degrees Cent., can be held for 40 hours without freezing. Incidentally he mentioned an instance where through a derailing accident, one of these cars actually was held for 36 hours before the metal was poured.

Methods and instruments for measuring the temperature of molten cast iron were described in a paper prepared by H. T. Wensel and W. F. Roeser, associate physicist and assistant physicist respectively, bureau of standards, Washington. The paper was presented by H. T. Wensel.

Consider Refractories

Report of the subcommittee on refractories for gray iron foundries was submitted by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, at the cast iron metallurgy session, Thursday. In collecting data for this report a questionnaire was sent to 200 foundries in various parts of the country. Replies were received from 56 and the character of these replies seems to indicate that the most extraordinary variations exist in the practice and conditions obtaining in gray iron foundries.

To the question regarding the life of a brick lining the answers varied from 9 hours to 6 months. Only one foundryman reported the use of a hard brick in the abrasion zone and a soft brick in the zone of fusion. One foundryman operating his cupola 8 hours per day gave his repair cost as 6 cents per ton of finished castings. A second foundryman operating under the same conditions stated that his cost was $1.68 per ton. This cost included materials and labor. A possible explanation for this extraordinary spread may be due to the method of apportioning expenses. Incidentally the same chaotic feature of foundry cost accounting was discussed at a cost meeting the previous day. The report prepared in the form of a chart by Mr. McKenzie was referred to the general refractories committee of the association for consideration.

John Shaw, Southsea, England, presented a paper on "Theory or Practice in the Gray Iron Foundry." This eminent British foundryman challenged many of the theories generally accepted on the silicon-carbon, manganese-sulphide combinations, also the effects of phosphorus and many of the ideas prevalent in regard to perlitic iron. He stated that his experience led him to hold divergent views, but that he still was a student and would welcome discussion on the subject. He presented several charts in support of his findings and claimed that foundrymen were too prone to accept theories without making investigation for themselves. Most of the experiments on which these theories were founded were conducted in the laboratory and did not work out in practice.

In discussing this paper and later in the presentation of his own paper "Research Problems of the Gray Iron Foundry," J. W. Bolton, Lunkenheimer Co., Cincinnati, pointed out that lack of complete knowledge of the engineering properties of gray iron deterred engineers from extensive utilization of this metal. Gray iron is not a single metal but a series of alloys varying widely in composition and physical properties. Gray iron may be classified into 40 or more groups according to their silicon and carbon contents. The irons within these groups are to be subdivided further according to their cooling rates. The session was held under the chairmanship of H. W. Gillett, bureau of standards, Washington.

Furthers Apprentice Training

TRAINING of foundry apprentices has made great forward strides in this country during the past few years, according to speakers at the session on apprentice training, Thursday morning, presided over by E. S. Sparks, secretary, the Metal Manufacturers' association of Philadelphia. However, attention was directed to the fact that the foundry industry appears to be suffering from an inferiority complex, and that this inferiority complex is reflected particularly in the relative status of apprentices in foundries and in machine shops. In the machine shops, for instance, apprentices are treated in a real lordly way, being provided with shower baths, lockers and other facilities, while it is not unusual for the foundry apprentice to be restricted in facilities to a nail hammered into the side of a sand-bin, to which he can hang his coat and hat.

L. A. Hartley, National Founders association, voiced a suggestion which caused considerable enthusiasm. He felt that it was advisable not only to make apprentice training work as effective as possible for the purpose of producing good workers, but that an opportunity should be provided to enable especially keen apprentices to pursue their studies further before going into the industry. He favors the establishment of research fellowships at various technical institutions, Carnegie Institute of Technology, for instance. Such fellowships could be maintained at around $1200 a year. Boys, after taking their regular apprentice course, could be made the recipients of fellowship awards which would make it possible for them to spend a year at some high-grade college or university, devoting their attention to some line of research, with full co-operation of the college or university staff. Efforts of this kind would do much to stimulate research work in the foundry industry, and he thought the effects of such a step would be far-reaching.

Two newcomers to these meetings were present and were asked to make remarks. They were C. P. Walker, Joubert & Goslin Machine & Foundry Co., Birmingham, and C. R. Smith, of the faculty of the high school at Chester, Pa., both of whom are doing effective work in training of foundry apprentices. Mr. Walker said that when he went to Birmingham, 12 years ago, he had difficulty in finding molders capable of making molds for heavy castings, and he had to train

all of his men. At the present time, he has two apprentices to every three molders, and says that he would be unable to operate long without these boys. To stimulate their enthusiasm, he has organized his apprentices into a baseball team, and he employs other means for stimulating their interest. Mr. Smith described the methods employed by the high school at Chester, in conjunction with the steel foundries of Chester, to train apprentices in the molding trade.

Mr. Hartley, in the general discussion, made the interesting point that the foundries which are busiest are the foundries which have the largest number of apprentices. For instance, the foundry in Philadelphia which is busiest, operating nights and Sundays, also has the largest number of apprentices. His inference was that the most progressive foundries do not fail to go into apprentice training on a large scale.

A distinguished figure present at this session was C. B. Connelly, dean of industrial relations, Carnegie Institute of Technology, Pittsburgh. He expressed great enthusiasm over the suggestion that fellowships in foundry research be established for the benefit of young men who have completed their apprenticeship, and it was his belief that great benefits would accrue to the foundry industry from such an action. Dean Connelly pointed out the dangers resulting from payment of excessively high wages to apprentices. He noted, for instance, that some industries with which he has contact are paying apprentices as high as $45 a week, whereas the journeymen are receiving $60 a week. By creating a wider spread in favor of the journeyman, he said, incentive becomes a stronger factor with the apprentice.

F. A. Lorenz, works manager at the Indiana Harbor plant of the American Steel Foundries, decried the attitude of certain large corporations toward training of apprentices, pointing out that certain of the country's largest interests have failed to make any progress whatever along this line, leaving it to smaller concerns to create skilled men.

However, a review of what has been done recently in different parts of the country in training of apprentices, clearly indicates that the forward movement of this work now is at an accelerated pace. A gratifying feature of the discussion was the revelation that much of the work now being done is the direct result of the findings of the committee on training of apprentices of the American Foundrymen's association in recent years.

The program of the apprentice training session was handled in a unique manner. First, C. F. Bauder, director of the department of industrial arts of the Philadelphia public schools, and F. A. Lorenz, works manager at Indiana Harbor, for the American Steel Foundries, summarized the preprinted papers dealing with apprentice training in different sections of the country. Then followed remarks by the various individuals who had prepared the reports.

C. D. Carey, president, Pittsburgh Foundrymen's association, submitted an interesting report on training of apprentices as now organized in the Pittsburgh district. Due to lack of printed foundry text-books of a suitable character, said Mr. Carey, the association at Pittsburgh now has under preparation four text-books which cover the technique of the foundry industry and these books will be ready for publication in November. To stimulate interest, the Pittsburgh Foundrymen's association, offered prizes for the best essays on foundry subjects, and the association is making arrangements to extend a banquet in the near future to 105 boys who submitted essays in the contest.

Walter Simon, director of apprentices of the committee on industrial relations of the state of Wisconsin, and C. J. Freund, Falk Corp., Milwaukee, told of the gratifying progress in apprentice training in the foundry industry in Wisconsin. John Ploehn and S. M. Brah, Moline, Ill., told of the organization for training of apprentices in the Quad-city district. W. J. Hebard, Detroit, apprentice consultant, International Correspondence schools, reported on apprentice training in the Detroit district. Charles F. Bauder reported on developments in the Philadelphia district. H. R. Packard, secretary-manager East Chicago chamber of commerce, reported on training of foundry apprentices at East Chicago, Ind. An extensive report on the apprentice system of Fairbanks, Morse & Co., was submitted by F. J. McGrail, foundry consultant at that company's Sheffield works, Three Rivers, Mich.; this paper was entitled, "The American Boy in the Foundry." A report on foundry apprenticeship in Oakland, Calif., was submitted by H. L. Martin, Oakland. W. B. Keast, district apprentice supervisor, Harvey, Ill., told of the work as it is organized at Harvey.

Loyalty Is Needed

AN INTERESTING paper on foundry management was presented by A. D. Lynch, Ohio Brass Co., Mansfield, O., at a session presided over by H. Cole Estep, Penton Publishing Co., Cleveland. Mr. Lynch stressed the importance of securing the loyalty and understanding co-operation of employes. His company has obtained noteworthy results by going over cost details with men in each department; for instance, by explaining to the men that even though they work on a piece work basis, any time lost by them during working hours means a loss in overhead to the company. Whereas the company formerly had a labor loss of 42 cents per productive hour, this loss has been reduced to 35 cents by getting the co-operation of the men all through the plant.

Mr. Lynch stated that no business concern makes so much profit under present competitive conditions but that it can afford to lay its cards on the table with its men and ask for their co-operation. He stressed especially the importance of building around the foremen, of placing responsibility on their shoulders and putting them in a position to earn the respect of the men.

A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., in discussing Mr. Lynch's paper, told about the necessity of watching the item of labor expense at such times as the plant has a great deal of work to do, since the turnover easily can eat up profits which otherwise would be retained.

J. D. Towne, consulting engineer, Dayton, O., discussed basic principles of foundry management. By means of time studies it is possible to work up charts which in effect constitute a budget control of man hours. He said there is one Western foundry where this system has been worked up to such a point that the management, no later than Friday of each week is able to advise the heads of each department just how many man hours will be required in carrying out the work scheduled for the coming week. He discussed other details which enable the management to plan operations ahead, and said that it frequently is possible to get customers to co-operate in such a way as to plan operations ahead, thus keeping the volume of operations more uniform.

J. H. Marks, Packard Motor Car Co., Detroit, was introduced by Fred Erb, Erb-Joyce Foundry Co., Detroit. Mr. Marks spoke on the subject,

"What Does the Buyer Expect for his Money," and stated that hand-to-mouth buying is economically sound. The automobile manufacturers, for instance, receive materials, manufacture them into automobiles and sell them, all within a few days, thus reducing interest on money tied up in the materials. He believes that it is essential for every castings manufacturer to study all costs factors, so that he will be able to give the buyer the large measure of value which is the rule under present competition for business.

Sand Committees Give Reports

INTENSE interest was shown at the session on sand control held Thursday afternoon under the direction of Banjamin D. Fuller, Whitehead Bros. Co., Cleveland. More than 200 attended the session which was interspersed with discussions and questions. Mr. Fuller first called upon Dr. Henry Ries, Cornell university, Ithaca, N. Y., to present the report of the subcommittee on sand tests. The report of the subcommittee on sand conservation and reclamation then was presented by R. F. Harrington, Hunt-Spiller Mfg. Co., Boston. A. A. Grubb, Ohio Brass Co., Mansfield, O., reported on grinding of sands.

Following the reports of the committeees T. F. Kiley presented a paper on "Sand Control and Sand Conservation in a Gray Iron Jobbing Foundry." This paper described the methods in use at the Brown & Sharpe Mfg. Co. Providence, R. I., at which the author is metallurgist. M. A. Blakey, International Harvester Co., Milwaukee, presented his paper on "Testing Molding Sands for Durability," and was followed by W. G. Reichert, Singer Mfg. Co., Elizabethport, N. J., with a paper on "Sand Control Methods for a Light Casting Foundry." Papers also were presented by H. L. Campbell, University of Michigan, Ann Arbor, Mich., on the effect of sand on the surface of castings and by G. G. Brown who was co-author with C. C. DeWitt on a strength test for sand.

Those who participated in the discussions included A. A. Grubb, Ohio Brass Co., Mansfield, O.; R. F. Harrington, Hunt-Spiller Mfg. Co., Boston; D. M. Pugh, W. S. Tyler Co., Cleveland; O. W. Potter, Port Crescent Sand Co., Detroit; Mr. Preston, J. H. Herron Co., Cleveland; G. G. Brown, University of Michigan, Ann Arbor, Mich.; H. S. Cleland, Eastern Clay Products Co., Buffalo, and M. A. Blakey, International Harvester Co., Milwaukee.

Nonferrous Founding Attracts

IN A paper entitled "Science in the Foundry," presented at the nonferrous sessions Tuesday, E. F. Hess, Ohio Injector Co., Wadsworth, O., emphasized the necessity of keeping accurate records of the results obtained in the foundry when using such scientific instruments as the pyrometer, applying methods of sand control or in doing any kind of work that might be classified as scientific. Inaccurate pyrometer readings, he maintained, were worse than none at all, being likely to do more harm than good. In the discussion that followed H. M. John, Detroit Lubricator Co., Detroit, at the request of chairman G. H. Clamer, gave a resume of the methods used by his company in calibrating pyrometers. He stated that the company aimed to get readings of metal temperatures, accurate to within, plus or minus 10 degrees Fahr. However, he doubted whether they succeed in doing this, but feels the readings are within 15 degrees. Pyrometers are calibrated every 6 months, by the manufacturer. More than one trained operator is employed and a check reading is secured on every pot of metal. One is made at the furnace and the other at mold side. The company has found it highly desirable to pour a maximum number of molds from each pot under a small temperature range so the castings in the last mold poured compare favorably with those poured first. The pouring temperatures vary with the type of castings; some have to be poured around 2300 degrees, while others may be poured cooler. Of course the pouring temperature giving the best results for a particular casting, had to be determined beforehand.

A paper by R. R. Clarke, entitled "Risers, Their Need and Feeding," was illustrated by charts and shows various methods of using risers to offset the effects of shrinkage. Mr. Clarke has found it sometimes economical to use a better grade of metal, one having less shrinkage, in cases where trouble was experienced from shrinkage when the addition of risers complicated the method of molding and was responsible for a material loss of production.

During the discussion J. F. Decker, Paul S. Reeves & Co., asked for an explanation of a phenomena he had encountered in making impeller castings weighing about 4000 pounds. Occasionally the riser would bulge but when cut off the metal underneath was found to be perfectly sound, whereas the contrary should be the case. Mr. Clarke thought this to be a gaseous condition of the riser brought about by some obscure cause. Occasionally he has noted this trouble, and has found he can correct it by the addition of a small amount of pulverized phosphor copper, just enough to make the metal in the riser liquid. While it was customary for some foundrymen to feed their risers with metal hotter than that used for pouring, he has found that often this extra hot metal is responsible for porosity extending down into the casting. He does not favor such methods.

A paper on furnace refractories by H. M. St. John developed some discussion on the effect of lead on silicon carbide refractories. The lead may react with the silicon carbide and silicon is added to the metal. This is a highly undersirable constituent, since it produces a lead silicate dross which enters the castings. This is not so likely to occur with a lead content of under 10 per cent, unless a flux was present. Since even borax will aid the reaction, it is necessary to keep fluxes away from any melting vessel consisting of this particular refractory when melting alloys containing a moderate amount of lead.

The subject of hard spots in leaded alloys was introduced by G. H. Clamer, but no one seemed to know positively what caused them. The theory was advanced that the hard spots might be caused by ferrophosphorus formed by the combination of the phosphorus

with iron in the bronze, this iron phosphide being an exceedingly hard substance. It was stated that the subject of refractories is of great importance to the brass founder as much trouble is experienced, due to the defects of the binders. However, work carried out by the bureau of standards has shown that this defect may be overcome by the use of colloidal binders.

In discussing the paper "The Effect of Melting and Pouring Conditions upon the Quality of No. 12 Aluminum Alloys," by T. W. Bossert, Aluminum Co. of America, New Kensington, Pa., G. H. Clamer called attention to the difficulty of porosity, cracking and shrinking. Mr. Bossert stated this was caused by overheating the metal while it was being melted. Even though it was cooled to the proper temperature before the castings were poured the previous overheating was responsible for the difficulty experienced. It was stated this is a point to be watched in making aluminum castings. The theory also was advanced that these difficulties may be caused by oxidation of the metal. The oxide may form a film around the crystals, affecting natural cohesion and acting like a parting on a mold.

The round table discussion on brassfounding was occupied largely with that eternal problem and bugbear of the brass foundryman, namely porosity. Silicon was not regarded highly for making sound copper castings of high conductivity, because of the effect of minute amounts on the conductivity. However, good results have been attained with boron carbide, but it has been found necessary to superheat the copper. The particular temperature was not mentioned, but it should not be under 2400 degrees Fahr. Under the proper conditions a conductivity of over 90 per cent could be obtained by the use of this modifier.

One foundryman stated that in the case of brass and bronze castings porosity had been largely eliminated by careful attention to such essentials as melting, sand control with reference to moisture and permeability and supervision of the manner of making the molds, to avoid ramming irregularities. Attention given these has paid dividends in the shape of sound castings. It also was considered highly desirable to so regulate furnace atmospheres to avoid either of two extremes, namely a strongly reducing, or a strongly oxidizing atmosphere. Some little difference of opinion on this point developed, but the consensus of opinion was more favorable to the avoidance of the reducing atmosphere. A slightly oxidizing atmosphere in the furnace to avoid the deposition of carbon was considered good to aim at, to avoid porosity troubles. In the opinion of a number of those present, the building up of nickel in ingot metals in the case of red brass such as 85, three fives was not harmful but rather the opposite. It improves the density, provided it does not exceed 0.75 per cent. However, when this amount was exceeded the metal may shrink a little more than it did normally, thus necessitating heavier gating. The liquid condition of the brass is increased by the addition of nickel, one case cited where it is added regularly up to 1 per cent. This improves the liquidity, renders possible a decrease in casting temperature, which might be as much as 100 degrees Fahr. Modern brass foundry practice favors the addition of nickel some adding 0.5 per cent while others make 0.35 per cent as a maximum. As chromium now is encountered in scrap metals, though, as yet, only to a limited extent, the question was brought up as to what effect this element might have on the secondary metal situation. Few had any experience, but it was thought that it would cause trouble, due to the fact that this element was not soluble in brass as was nickel.

The use of permanent molds in brass foundries was discussed. A semipermanent mold was mentioned, which is used to cast propeller blades in manganese bronze, the weight of the blades being from 5000 to 8000 pounds each. The mold is made of a refractory material in the main and several ways are employed in making it. Parts of the mold which would be destroyed by the contraction of the metal are formed of replaceable cores. Each mold is good for 27 castings.

A question arose as to the amount of lead that could exist in a manganese bronze without affecting the strength of the material. It was thought this was governed partly by the tin content. Some allowed 0.4 per cent, others 0.2 per cent.

Transportation Is Important

FOUR papers dealing with the subject of material handling in the foundry were presented at the closing session of the convention held in the lecture hall of the Commercial museum Friday with L. L. Anthes, Anthes Foundry Co., Toronto, Ont., in the chair.

In a paper entitled "Materials Handling and Its Relationship to Building Plants," E. F. Scott, the Austin Co., Cleveland, directed attention to the extreme necessity of proper layout of equipment and buildings. He enumerated the main equipment items required in a modern foundry and showed how intimately they are connected with the building features. Every foundry is a problem to itself, but the generalities outlined served to show that the development of a new plant or rehabilitation of an old one demand the best and most available foundry engineering talent.

Summing up his paper "Determining Returns from Materials Handling Equipment," J. J. Hartley, engineer, Link-Belt Co., Chicago, claimed that the problem involves common sense use of simple accounting methods; co-ordination of the plan with production requirements; careful estimating entire cost of proposed equipment; conservative estimate on returns; and a wide awake management with the necessary capital and courage to back the plan. Two interesting tables were presented to show the feasibility of installing equipment when: 1—The estimated reduction in cost per ton has been determined. 2—To show the amount it is practical to spend for each $1 per day earning power of the equipment.

"What Material Handling Equipment Can Do for the Jobbing Foundry," was discussed in a paper presented by W. B. Marshall, Chain Belt Co., Milwaukee. Contrary to a somewhat prevalent idea, he claimed that mechanical equipment can be installed to a considerable extent with profit in the jobbing foundry. He instanced several plants where actual experience has shown that a material saving in costs has been effected.

Application of the electric truck to material handling in the foundry was described by Harold J. Dorus and C. S. Schroeder, the Yale & Towne Mfg. Co., Stamford, Conn. In the discussion which followed the reading of the various papers attention was directed to the point that intelligent supervision and maintenance must be observed for proper results

L. W. Olson *P. J. Krentz* *B. H. Johnson* *S. Wells Utley* *C. E. Hoyt*

Elects Five Directors

ANNOUNCEMENT of the election of five members to the board of directors of the American Foundrymen's association, was made at the business meeting Tuesday morning. Those elected for three year terms are as follows: S. W. Utley, vice president, Detroit Steel Casting Co., Detroit; L. W. Olson, works manager, Ohio Brass Co., Mansfield, O.; B. H. Johnson, general works manager, Cresson-Morris Co., Philadelphia; Peter J. Krentz, vice president and works manager, Buffalo Foundry & Machine Co., Buffalo; C. E. Hoyt, executive secretary, American Foundrymen's association.

L. W. Olson

L. W. Olson, re-elected to the board of directors has served as president and vice president. Also as member of the board on a former occasion. He is a graduate of the University of Wisconsin with the class of 1899. He followed construction work for two years and then became connected with the Ohio Brass Co., Mansfield, O., in the capacity of draftsman. He was made factory superintendent of that organization in 1907 and was placed in his present position as factory manager in 1920.

Peter J. Krentz

Peter J. Krentz, whose election for a three-year term as member of the board of directors of the American Foundrymen's association was announced at the business meeting, is vice president and works manager of the Buffalo Foundry & Machine Co., Buffalo. He has been connected with that firm since 1903, first as pattern-maker foreman and later in various positions of responsibility. In 1906 he was appointed superintendent and was made manager during the war.

Mr. Krentz is a native of Buffalo where he started to learn the pattern-making trade with the old George W. Treffts Co., at the age of 14. After finishing his apprenticeship he remained with that company until 1901 when he left to organize a shop of his own. He operated this shop until 1903 and then joined the newly organized Buffalo Foundry & Machine Co.

B. H. Johnson

B. H. Johnson, a new member of the American Foundrymen's association, was born in Lynn, Mass., where he also received his early education. His technical education was received at the Massachusetts Institute of Technology. After graduating from that institution he entered the employ of Taylor & Gooding, engineers and machinists, Lynn, Mass. When that firm was merged with the John T. Robinson Co. Mr. Johnson was appointed superintendent.

In 1910 he became connected with the Cresson-Morris Co., Philadelphia, and now is works manager for that company. He has been actively connected with foundry and metal associations in Philadelphia. He is chairman of the committee on costs and chairman of the committee on education with the Metal Manufacturers association of Philadelphia. He is secretary of the board of directors of the Philadelphia Foundrymen's association and vice president of the Gray Iron institute.

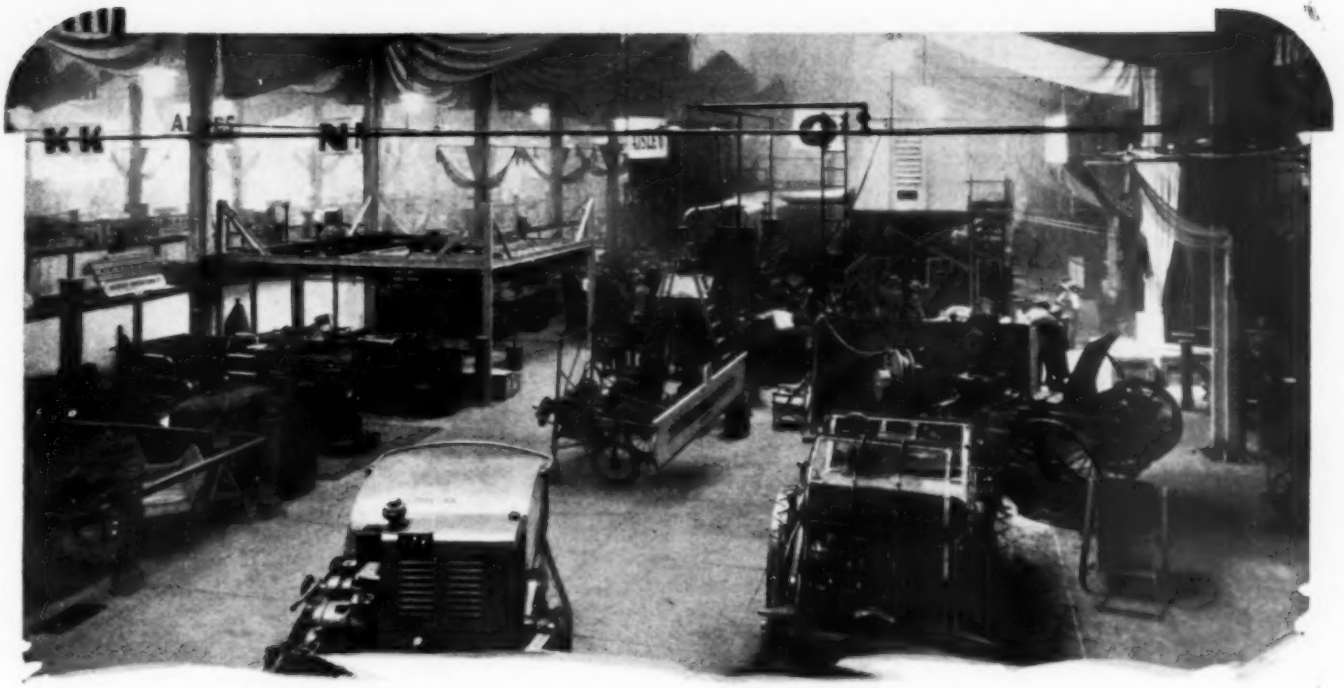
S. Wells Utley

S. Wells Utley, elected as one of the board of directors of the association for the ensuing three-year term, was vice president in 1926 and president for a short and a long term respectively in 1927 and 1928. The difference in length of the terms was due to the action of the association in changing the annual convention from the fall to the late spring or early summer. Mr. Utley was elected at the Detroit convention in 1926.

Mr. Utley was graduated from the University of Michigan in 1902 and then joined the American Radiator Co., Detroit, where he remained three years. At the close of that period he joined the staff of the Detroit Steel Casting Co., Detroit, and for several years has been vice president and general manager. Mr. Utley was made an honorary member of the American Foundrymen's association at the opening session on Tuesday of the convention week.

C. E. Hoyt

C. E. Hoyt, also re-elected to the new board of directors, is executive secretary of the American Foundrymen's association. Mr. Hoyt, early in his career, became associated with the foundry industry as instructor in foundry and patternshop practice at the Michigan State Agricultural college. Three and a half years later he accepted a similar position with the Lewis institute, Chicago. He was elected secretary of the Associated Foundry Foremen at the Toronto convention in 1908, and in 1909 became secretary of the Foundry Supply association. When that organization was succeeded by the Foundry & Machine Exhibition Co. in 1911, he was made secretary of that body, and when the exhibition feature was taken over by the American Foundrymen's association in 1916, he was made manager of exhibits. Two years later he was elected secretary of the association and several years ago was made executive secretary.



Shows Industry's Progress

Philadelphia Exhibition Rivals Previous Shows in Number of New Developments Displayed by Equipment Manufacturers

PROGRESS, as exemplified by the perfection of existing machines and the development of new types of equipment, never was better illustrated than at the Philadelphia exhibition of foundry equipment and supplies held at the Commercial museum, May 14 to 18, in connection with the annual convention of the American Foundrymen's association. The show indicated the great amount of time and money spent by manufacturers, since the previous exhibition in Detroit, to assist foundrymen to produce quality castings at the lowest possible cost.

The show was outstanding for the completeness of the exhibits. Practically every display included the entire line manufactured by the exhibiting company. The trend toward the complete mechanization of foundry operations was well illustrated by many types of equipment including large exhibits of molding machines, interesting displays of sandblast, grinders, chippers and other types of cleaning room equipment, and operating exhibits of material handling equipment.

The Philadelphia exhibition was the largest ever held under one roof, and on the same floor level. Arrangement of the exhibits divided the exhibition into three main sections. Four rows of booths running lengthwise through the center of the exhibition hall contained displays of foundry supplies, sand, grinding wheels, core compounds, metals, crucibles and other melting equipment, welding equipment, core machines, safety equipment, etc. The two outside sections held the large operating exhibits which attracted considerable attention during the week. Reports indicate that considerable equipment was sold during the show.

Equipment Covers Entire Field

REFINEMENT and improvement in existing models marked many of the molding machines exhibited at the Philadelphia show. In some, additional features had been incorporated while in others the operating mechanism had been improved and simplified for greater speed and ease of operation. Molding machine manufacturers were represented to an unusually complete extent. The lineup included everything from the small hand squeezer to large rollover jolt machines operated in connection with runout tables, sand handling equipment and various types of conveyors.

Tabor Mfg. Co., Philadelphia, showed several new machines including one designed for multiple molding. It is equipped with two pattern plates, one mounted directly on the jolting table, and the other attached to the squeezer head above. In practice the flask

is placed on the lower plate, filled with sand, partly jolted and then pushed up against the squeeze plate containing the second parts of the split patterns. Thus when the flask is lifted away it contains the drag impression for one mold and the cope impression for another. The flasks are stacked on top of each other to any desired height and all are poured through a single vertical runner. Several other machines also were shown.

Osborn Mfg. Co., Cleveland, had an unusually large display of molding machines, sand treating equipment, sand and mold handling equipment in operation. Large molds were made on one machine while small molds were made on a squeezer and placed on a conveyor. The molds are carried on the conveyor through the pouring station to the shakeout. The empty flasks are returned to the molding stations on the conveyor and the sand is elevated to a horizontal bar mill located above. After the sand is prepared, it is discharged into bins located above the molding stations.

Johnson & Jennings Co., Cleveland, showed a wide range of molding machines including a new type recently developed in which three cylinders are employed to jolt the sand, roll the mold and draw the pattern. An air-operated clamp holds the mold in place during the rolling operation while an equalizer adjusts itself to the bottom board to a draw perpendicular to the plane of the pattern plate. This company also showed various foundry accessories including vibrators and hard iron stars.

Beardsley & Piper Co., Chicago, staged an interesting exhibit of two machines in operation. One machine was equipped with motor mechanism and was mounted on a length of railroad track to demonstrate its use over a long line of molds set up on the floor. The other machine was of the tractor type mounted on two long racks laid on the floor and designed to move forward at any given speed to suit the character of the molds which are placed in rows to the rear as the machine advances over the sand heap.

Arcade Mfg. Co., Freeport, Ill., showed a number of hand operated and power operated molding machine including jolt squeezers, jolt strippers, and air strippers. Core machines and pouring outfits also were shown. Three types of plain squeezing machines, two types of jolt squeezer machines, one plain squeeze pattern draw machine, also vibrators, flasks and riddles were shown by the Berkshire Mfg. Co., Cleveland. The Herman Pneumatic Machine Co., Pittsburgh, showed a few of its smaller rapid production type jolt, rollover and pattern draw machines and a new heavy type jolt machine.

International Molding Machine Co., Chicago, exhibited a wide variety of molding machines including jolt squeezers; post jolt squeezers; jolt squeeze, strip machines; jolt hand stripping machines, jolt, power stripping machines; jolt power lifting machines; plain stripping machines; jolt-ram power turnover; power draw machines; and turnover core draw machines.

Milwaukee Foundry Equipment Co., Milwaukee, showed motion pictures of its machines in operation in various foundries. A large variety of molding machines of various types, including a large jolt-squeeze machine equipped with a runout table, was exhibited and operated by Wm. H. Nicholls Co. Inc., Brooklyn, N. Y.

Interesting Exhibits of Material Handling Equipment, Molding Machines and Compressors Were Shown in Operation

Foundry interest in mechanical preparation and distribution of sand was evidenced by the wide range of equipment for this purpose shown by several exhibitors. The Royer Foundry & Machine Co., Wilkes-Barre, Pa., showed several models of its sand separator and blender which utilizes a rapidly moving belt. The Axmann Sand Throwing Machine Co., Cleveland, showed several machines in operation, conditioning sand, filling an overhead bin and conveying sand from one point to another. The Jeffrey Mfg. Co., Columbus, O., demonstrated a sand conditioning machine employing a revolving drum with projections and a brush.

Exhibit of the C. O. Bartlett & Snow Co., Cleveland, included full size units for conditioning sand. The display included a continuous sand blender, pug mill, condenser, elevator, and conveyor parts. Portable screens and riddles were shown by the Deister Concentrator Co., Fort Wayne, Ind., Lowe Mfg. Co., Detroit, and Great Western Mfg. Co., Leavenworth, Kans.

National Engineering Co., Chicago, showed a 6-foot muller type mixer equipped with a speed reducer, motor base and couplings, and a 3-foot diameter pan mixer with motor and worm gear reducer to illustrate the operation of this machine. That company also showed sections of conveying equipment.

A new type core and facing sand mixer, equipped with motor and speed reducer drive, roller bearings and a hexagonal screen was shown by the Standard Sand & Machine Co., Cleveland.

Wadsworth Core Machine & Equipment Co., Akron, O., showed core making machines, machines for cutting and coning cores, machines for testing cores, and steel core and flask plates. Pneumatic machines for blowing cores under pressure were shown by Wm. Demmler & Bros., Kewanee, Ill.

Sand control and sand testing equipment was shown at the booth of Harry W. Dietert, Detroit. A portable instrument for determining the moisture content of molding sand was displayed by R. W. McIlvaine Co., Chicago. That company also showed photographs of sand and mold handling systems and cupola charging apparatus.

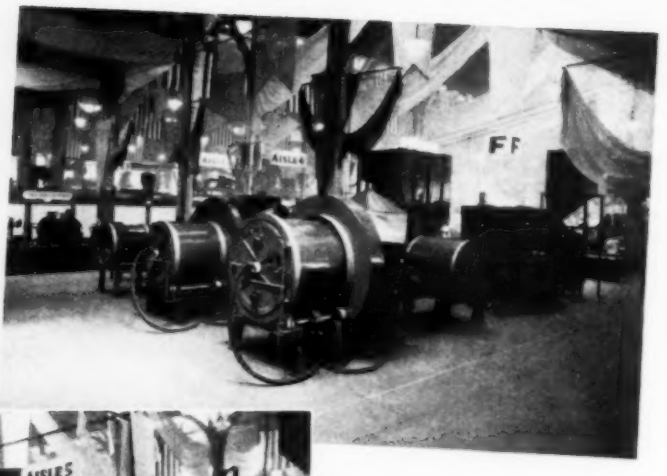
A complete shakeout bail, vibrators, a large knockout machine, a new small knockout machine, a core grinding machine and a line of ladles, hose clamps and fittings were shown by the Stoney Foundry Engineering & Equipment Co., Cleveland. An extensive line of vibrators including flask rappers, pot rappers, long strike vibrators, also several regular and special type vibrators were shown by the Malleable Iron Fittings Co., Branford, Conn.

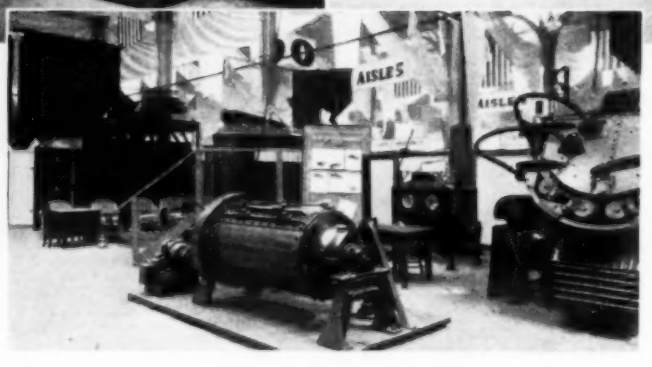
A wide range of cranes, monorails, stationary hoists, hand and power operated, was shown by a long list of exhibitors including: American Engineering Co., Philadelphia; American Monorail Co., Cleveland; Box Crane & Hoist Corp., Philadelphia; Cleveland Crane & Engineering Co., Wickliffe, O.; Louden Machinery Co., Fairfield, Ia.; Northern Engineering Works, Detroit; Reading Chain & Block Corp., Reading, Pa.; Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Several types of buckets in operation were shown by the Blaw-Knox Co., Pittsburgh; Hayward Co., New York, and G. H. Williams Co., Erie, Pa. Electrical industrial trucks, electric and hand power hoists were shown by the Yale & Towne Mfg. Co., Stamford, Conn. The Link-Belt Co. showed a mold conveyor in operation, speed reducers, belt conveyor idlers,

Displays of Melting Equipment, Metals and Core Compounds Attracted Considerable Attention

Large Exhibits of Sandblast Equipment Were Shown in Operation





These Included Rooms, Barrels, Automatic Tables, Cabinets and Tanks

vibrating shakeout, riddles, elevating machinery and drive chain, also photographs of its equipment in various foundries. Mathews Conveyor Co., Ellwood City, Pa., showed a conveyor loop 10 x 20 feet, made up of heavy duty foundry roller conveyor line.

Featuring the exhibit of the American Foundry Equipment Co., Mishawaka, Ind., were two new types of sandblast mills, 36 x 42 inches; a new type of sand cutter, containing a screening device and a new type of sandblast room, 8 x 8 feet, with dust arrester. Other items on display included a gravity barrel, pressure type cabinet, induction type cabinet, two core machines and equipment for straightening core rods.

Pangborn Corp., Hagerstown, Md., demonstrated a rotary sandblast table, 18 feet in diameter, designed to clean large castings. This machine is of the direct pressure type. A direct pressure sandblast barrel with loading attachment also was shown, as well as a new sandblast helmet of molded rubber equipped with an atmospheric water washed air ventilating device. Several interesting features were embodied in a sandblast room with the dust arrester mounted on the top. A cupola of the continuous type was displayed by the Whiting Corp., Harvey, Ill. This cupola has a postive safety tuyere, with a vertical fusible plate and ganister lined tuyere elbows. The company also featured a new type of helical geared ladle, with ball bearing tipping mechanism, and a small-sized dust filter for restricted headroom. The company also exhibited a full roller bearing electric crane, equipped with herringbone gears and a new style tumbling mill, with a special door clamp and a combination clutch and brake motor.

The New Haven Sand Blast Co., New Haven, Conn., exhibited a self-contained unit dust arrester unit for grinding equipment, a motor-driven tumbling mill, a side draft sandblasting and a unit spark eliminator and arrester. The W. W. Sly Mfg. Co., Cleveland, had a large exhibit which featured a steel molding sand reclaiming unit. This company also displayed a type of tumbling mill, equipped with ball bearings and employing a special exhaust principle. Three sizes of tilted sandblast mills were exhibited, also a positive pressure rotary table, and an 8-foot turn table cabinet. The reclaiming unit has capacity of two tons an hour. The Macleod Co., Cincinnati, displayed several types of sandblast machines, paint sprayers, blacking sprayers and oil burners.

The Sullivan Machinery Co., Chicago, demonstrated an angle compound compressor, 16 x 9¾ x 10 feet, with an automatic stop and start control. The machine operates at a constant speed and is equipped with a variable load control. It was used to supply air to the exhibitors. Also on display was a new direct connected vertical, which can be supplied in sizes up to 340 cubic feet per minute. A single stage, direct connected compressor was demonstrated, along with a compressed air hoist and an electric double drum portable hoist. The Carborundum Co., Niagara Falls, N. Y., displayed a new type of internal grinding wheel, a line of snagging wheels, a small core oven and two models of refractory furnaces. The wheels on display ranged from ½ to 36 inches in diameter and 1/32 to 4 inches in width. The Ingersoll-Rand Co., New York, demonstrated a line of rammers, a grinder for slab work and several sizes and styles of hoists. A rammer designed for ramming pipe was exhibited. Other items included an extension to the companies line of riveting hammers.

Portable electric tools of light weight and designed to maintain constant speed against all loads were exhibited by the Chicago Pneumatic Tool Co., New York. Another feature of the display was a new air compressor, 13½ x 8 x 10 feet. Chipping hammers, sand hammers, and air hoists were among other items displayed. The United States Electrical Tool Co., Cincinnati, O., exhibited a line of floor grinders, snagging grinders, and portable grinders. Included was a multi-speed grinder designed to have the speed changes conform to the size of the wheel, a high frequency grinder and a disk sander. A line of high-speed swing frame grinders and buffing machines were demonstrated by the Marschke Mfg. Co., Indianapolis, Ind., a subsidiary of the Black & Decker Mfg. Co., Towson, Md. A feature of the display was two types of grinders equipped with controls for maintain-

ing the surface speed of the wheel regardless of the reduction through wear. The company also exhibited a complete line of electric tools including drills, screw drivers, and socket wrenches. The Rotor Air Tool Co., Cleveland, exhibited a line of pneumatic tools, and as a special feature, a high production grinder specially designed for the use of rubber or bakelite bonded wheels. A line of floor stands, with narrow spreads between wheel centers, was demonstrated by the Bridgeport Safety Emery Wheel Co., Bridgeport, Conn. A radial swing frame grinder also was shown

The Independent Pneumatic Tool Co., Chicago, displayed chipping and riveting hammers, air hoists, and grinders, with a new rotary type grinder and sander. Electric nut and screw drivers and tappers and moisture separators also were displayed. Kling Bros. Engineering Works, Chicago, demonstrated a high-speed, double end grinder, designed for speeds up to 8500 revolutions per minute. A vitrified wheel for grinding steel castings was demonstrated by the Abrasive Co., Philadelphia. This company showed a bakelite wheel for grinding steel castings and billets at high speed and also one designed to grind cast iron and unannealed malleable iron. Raw materials for wheels also were shown. The Norton Co., Worcester, Mass., exhibited a floor stand snagging machine, equipped with 36-inch wheels, swing frame grinders, refractories, an abrasive floor material, and special wheels.

The Smith-Monroe Co., South Bend, Ind., demonstrated a compressed air separator used to remove oil and water in compressed air lines. The separated oil and water is discharged automatically by a small trap. The Titgen-Eastwood Co., Philadelphia, displayed a cupola and a line of sandblast machines. A line of molding equipment, consisting of snap flasks, steel jackets, bends, core plates, bottom plates, core boxes, foundry wedges, clamps and flask fittings, was shown by the Diamond Clamp & Flask Co., Richmond, Ind.

Many types of refractories in a variety of shapes and forms were shown by a number of companies. The Alpha-Lux Co. Inc., New York, exhibited a miniature cupola lined with a monolithic lining. An exhibit of samples of the lining in its raw state also was shown. Special crucible and refractory brick featured the exhibit of the Electro Refractories Corp., Buffalo. The Vesuvius Crucible Co., Swissvale, Pa., displayed a number of different types of crucibles. Graphite crucibles, nozzles, stoppers and clay refractories formed the exhibit of the Joseph Dixon Co., Jersey City, N. J. Pit type and tilting type graphite crucibles for use in nonferrous melting were shown by the Lava Crucible Co., Pittsburgh. In addition this firm also showed crucible covers, funnels, phosphorizers, etc.

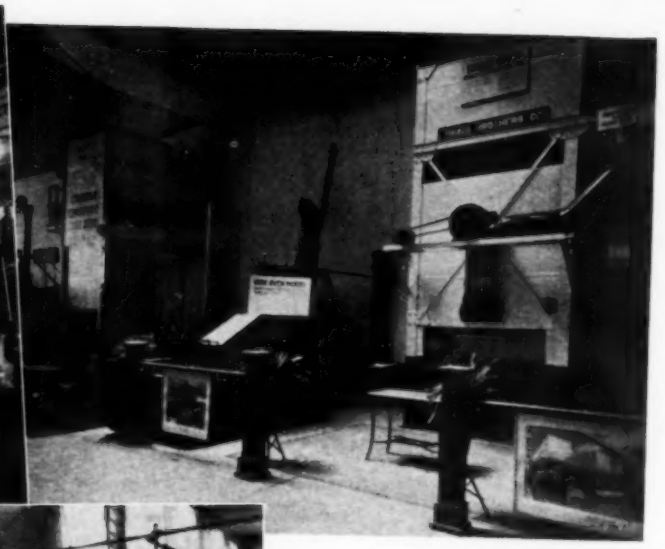
Castings made from a natural pig iron containing nickel and chromium were featured at the exhibit of the Bethlehem Steel Co., Bethlehem, Pa. Specimens of the different grades of foundry pig iron manufactured by the firm also were shown. The application of nickel to gray iron castings was shown in the exhibit of the International Nickel Co., New York. The exhibit was composed of a number of representative nickel-gray iron castings for various purposes. Foundry coke and foundry pig iron featured the exhibit of the Debevoise-Anderson Co., New York. A cupola flux for refining and desulphurizing cast iron, and a group of castings to show the effect of this flux were shown by the Mathieson Alkali Works Inc., New York. Specimens of foundry coke in various sizes were displayed by the Semet-Solvay Co., New York.

A multi-stage pulverizer, an impact pulverizer with an air separator and a burner for pulverized coal were exhibited by the Grindle Fuel Equipment Co., Harvey, Ill. The Chisholm-Moore Mfg. Co., Cleveland, had in operation a cupola charging machine; an overhead traveling crane; a new high-speed chain hoist; a roller bearing hoist with a hand wheel ex-

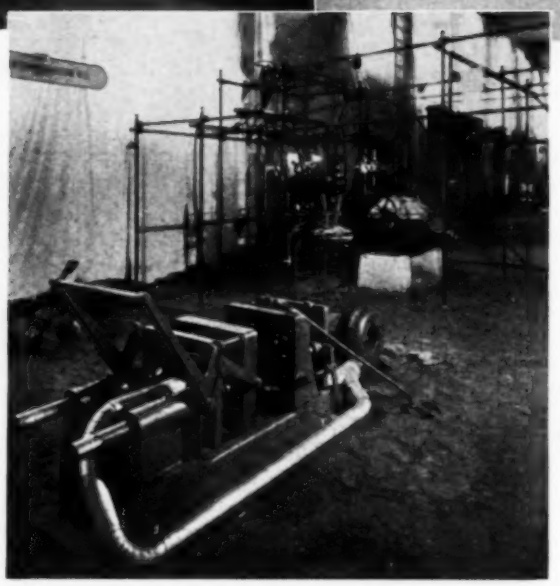
Equipment for Preparing Sand Received Considerable Attention

A View Down the Long Aisles Showed a Variety of Equipment

A Variety of Grinders Were Shown in Operation. An Electric Furnace Was Operated and the Metal Poured in Permanent Molds



Numerous Types of Core Ovens Were Shown by Several Manufacturers. These Included Continuous Elevating, Drawer and Rack Types



tension designed especially for handling flasks, ladles, etc.; and an electric hoist equipped with a special foundry control. Two turbine compressors for supplying air for foundry cupolas, oil and gas burners for core ovens and other industrial heating equipment were shown by the Spencer Turbine Co., Hartford, Conn.

Several different types of electric melting furnaces were exhibited by the Detroit Electric Furnace Co., Detroit; the Pittsburgh Electric Furnace Corp., Pittsburgh, and the Ajax Electrothermic Corp., Trenton, N. J. The Detroit Electric Furnace Co.'s exhibit consisted of a 100 kilowatt furnace with a capacity of 350 pounds per hour, with a transformer and control equipment. A group of castings made from metal melted in this type of furnace also was shown.

A 125-pound an hour electric furnace melting gray iron was in operation at the booth of the Pittsburgh Electric Furnace Corp. The metal was poured into a permanent mold machine exhibited by the Holley Carburetor Co., Detroit. The Ajax Electrothermic Corp. showed a high frequency and an induction type electric furnace as well as a number of accessories.

Monarch Engineering & Mfg. Co., Baltimore, had on display a variety of melting furnaces both of the crucible and noncrucible types using oil or gas as fuel. Other equipment displayed by this firm included core ovens, an automatic noncrucible melting furnace, a line of heat treating furnaces and a special soft metal aluminum furnace.

One of the features of the exhibition was the large variety of core binders that were displayed by a number of companies. These binders included linseed oil, linseed oil base, glutrin, flour, sulphite, etc. The firms exhibiting included Spencer Kellog & Sons Inc., Buffalo; Robeson Process Co., New York; Smith Oil & Refining Co., Rockford, Ill.; Werner G. Smith Co., Cleveland; Corn Products Refining Co., New York; Oiless Core Binder Co., Cleveland; Knefler-Bates Mfg. Co., Indianapolis; Swan-Finch Oil Co., New York; Lindsay-McMillan Co., Milwaukee, and William C. Robinson Co., Baltimore. Nearly all these firms exhibited cores of various types that were made with the binders manufactured by the companies. These cores were plain, intricate, and heavy types to show application of the binders.

Vent waxes and cores illustrating the uses of this wax were displayed by the United Compound Co., Buffalo, and the American Vent Wax Co., Lockport, N. Y. Graphite, plumbago, core washes and other graphite products for foundry use were shown at the exhibits of the Bloomsbury Graphite Co., Bloomsbury, N. J.; the United States Graphite Co., Saginaw, Mich., and the Asbury Graphite Mills, Asbury, N. J.

The Ames Shovel & Tool Co., Boston, showed different types of molder's shovels and scoops. Foundry flasks, trucks, wheelbarrows and other foundry specialties constituted the exhibit of the Sterling Wheelbarrow Co., Milwaukee. The Combined Supply & Equipment Co. Inc., Buffalo, exhibited a line of foundry chaplets, and the H. W. Knight & Son, Seneca Falls, N. Y., had a variety of pattern letters and figures, and foundry trade

marks of white metal and brass on exhibition. Samples of steel grit and steel shot for blast cleaning, and castings cleaned by this type of abrasive were shown by the Globe Steel Abrasive Co., Mansfield, O.

Exhibiting firms dealing in foundry supplies included Frederic B. Stevens Inc., Detroit; J. S. McCormick Co., Pittsburgh; S. Obermayer Co., Chicago; Pennsylvania Foundry Supply Co., Philadelphia, and the Hill & Griffith Co., Cincinnati. The Stevens company displayed a general line of foundry equipment, facings and supplies, and had a working exhibit of an automatic plating machine. A new core pasting machine, a new blacking mixing machine, and a line of foundry facings and supplies featured the display of the McCormick company. The S. Obermayer Co., showed its line of foundry materials, and a number of cores to illustrate the effect of the firm's blacking. A new type of flask equipment, binders, chaplets, molding sands, and other materials were shown by the Pennsylvania Foundry Supply Co.

T. B. Wood's Sons Co., Chambersburg, Pa., showed an aluminum taper-slip flask, a wood taper-slip flask and an automatic adjustable slip jacket, in various sizes. Pig iron, coke, ferromanganese, ferrosilicon, molding sands, aluminum and other materials for foundry use were displayed by Rogers Brown & Crocker Bros. Inc., New York. The Austin Co., Cleveland, showed photographs and drawings of foundry buildings and layouts.

The importance of the various types of sands in the foundry industry was illustrated well by the large number of companies displaying molding sands for ferrous and nonferrous metals, sandblast sands, fire clays and clay binders. Included in the companies exhibiting sands were the following: Portage Silico Co., Youngstown, O., Ayres Mineral Co., Zanesville, O., Whitehead Bros. Co., Providence, R. I., Eastern Clay Products, Inc., Buffalo, Standard Silica Co., Chicago, Illinois Clay Products Co., Joliet, Ill., Mt. Jewett Fire Clay Co., Mt Jewett, Pa., Ottawa Silica Co. Ottawa, Ill., Albany Sand & Supply Co., Albany, N. Y., George F. Pettinos, Philadelphia, Port Crescent Sand & Fuel Co., Port Crescent, Mich., Industrial Minerals Co., Columbus, O., and Paxson-Taggart, Inc., Philadelphia.

Continuous type core ovens are featured by several manufacturers. Young Brothers Co., Detroit, showed a large vertical type continuous oven and a model of a tunnel type continuous core oven. A rolling drawer type core oven, a rack type oven, and a vertical type continuous core oven featured the display of the Foundry Equipment Co., Cleveland. The Paul Maehler Co., Chicago, operated a rack type core oven equipped with gas heater and temperature control equipment. That company also showed several types of heaters and blowers. The display of the Swartout Co., Cleveland, consisted of a drawer type core oven, a portable type oven, and a typical lift door for a rack or car type oven.

The Linde Air Products Co., New York, had an interesting display of welding equipment consisting of a 20-cylinder oxygen manifold and a large acetylene generator. Piping from the manifold and the generator lead to the center of the booth where several types of cutting and welding nozzles were displayed. The General Electric Co., Schenectady, N. Y., is showing a portable welding unit, several electric motors, and a special type cupola blower.

Several types of annealing boxes were shown by the American Brake Shoe & Foundry Co., Chicago. An automatic die and mold cutting machine and a line of flexible shaft grinders featured the display of the Keller Mechanical Engineering Corp., Brooklyn, N. Y. Safety equipment for foundry workers was shown by the Pulmosan Safety Equipment Corp., Brooklyn, N. Y. Two metal cutting band saws were operated by the Wm. Laidlow Inc., Belmont, N. Y.

Steel window sash, pivoted windows, skylights, and roof designs were shown at the booth of David Lupton's Sons Co., Philadelphia. Information on the work of the company was presented by the Charles C. Kawin Co., Chicago. The Federal Foundry Supply Co., Cleveland, exhibited sand control apparatus, for use in foundry laboratories. The company also showed foundry supplies.

Display Shows Utility of Castings

CASTINGS of all sizes, shapes and forms, from light weight such as toys to the heavy type such as steel dipper boom, featured the castings exhibit which was participated in by 57 foundries at the annual convention of the American Foundrymen's association at Philadelphia. Approximately 200 castings were shown by the various firms of which 26 were gray iron, 19 were steel and 12 were malleable iron foundries.

Among the foundries displaying gray iron castings were the Arcade Mfg. Co., Freeport, Ill.; Bucyrus-Erie Co., South Milwaukee, Wis.; S. Cheney & Son, Manlius, N. Y.; Cushman Motor Works, Lincoln, Neb.; Frank Foundries Corp., Moline, Ill.; Hamilton Foundry & Machine Co., Hamilton, O.; E. C. Stearns & Co. Inc., Syracuse, N. Y.; Westinghouse Electric & Mfg. Co., Cleveland; Westinghouse Air Brake Co., Wilmerding, Pa.; American Cast Iron Pipe Co., Birmingham, Ala.; Bethlehem Steel Co., Bethlehem, Pa,; Cramps Brass & Iron Foundries Co., Philadelphia; Cresson-Morris Co., Philadelphia; Elyria Foundry Co., Elyria, O.; Forest City-Walworth Run Foundries Co., Cleveland; G. & C. Foundry, Sandusky, O.; Milwaukee Gray Iron Foundry Co., Milwaukee; Olney Foundry, Philadelphia; Palmyra Foundry, Palmyra, N. J.; Ross-Meehan Foundries, Chattanooga, Tenn,; Sterling Foundry Co., Wellington, O.; Wessling Bros. Foundry, Cincinnati; Western Foundry Co., Chicago; Wisconsin Cylinder Foundry, Racine, Wis., Westinghouse Electric & Mfg., Philadelphia, and the International Nickel Co., New York.

Steel foundries that supplied steel castings for the exhibit included the Ohio Steel Foundry Co., Lima, O.; Clark Equipment Co., Buchanan, Mich.; Falk Corp., Milwaukee; Milwaukee Steel Foundry Co., Milwaukee; Sivyer Steel Casting Co., Milwaukee; Chicago Steel Foundry Co., Chicago; Wheeling Mold & Foundry Co., Wheeling, W. Va.; George H. Smith Steel Casting Co., Milwaukee; Lebanon Steel Foundry, Lebanon, Pa.; Commercial Steel Casting Co., Marion, O.; Eastern Steel Castings, Newark, N. J.; Crucible Steel Casting Co., Lansdowne, Pa.; Fort Pitt Steel Casting Co., McKeesport, Pa.; Dusquesne Steel Foundry Co., Pittsburgh; Michigan Steel Casting Co., Detroit; Nugent Steel Castings Co., Chicago; Dodge Steel Co., Philadelphia; Riverside Steel Casting Co., Newark, N. J.; Western Crucible Steel Casting Co. Minneapolis and the Detroit Steel Casting Co., Detroit.

Malleable iron castings were shown by the American Chain Co., York, Pa; Erie Malleable Iron Co.,

More than 200 Castings of Various Sizes and Shapes, and Weighing from a Few Ounces to 1500 Pounds Were Displayed by the Various Ferrous Foundries Participating in the Exhibit

Erie, Pa.; Fort Pitt Malleable Iron Co., Pittsburgh; Jamestown Malleable Products Corp., Jamestown, N. Y.; Malleable Iron institute, Cleveland; National Malleable & Steel Castings Co., Cleveland; Northern Malleable Iron Co., St. Paul; Northwestern Malleable Iron Co., Milwaukee; Rhode Island Malleable Iron Works, Hillsgrove, R. I.; Baltimore Malleable Iron & Steel Casting Co., Baltimore, and the Jefferson Union Co., Lockport, N. Y.

Each of the castings displayed was marked with a small card giving pertinent information. In many cases, the casting had replaced a part constructed of other materials, or built-up structural members. The casting saved constructing time besides eliminating a large number of small parts, rivets, etc. The casting also withstood the service conditions much better than the part replaced.

Many of the gray iron castings shown contained chromium and nickel which, according to the exhibitors, gave certain desired physical properties. Some of the steel castings displayed also were of the alloy type for special service conditions.

Responsibility for assembling the malleable castings shown in the exhibit was assumed by the Malleable Iron Research institute of which Robert E. Belt, Cleveland, is secretary.

Similarly, the Steel Founders' Society of America, acting through its secretary-manager, W. J. Corbett, developed the various features tending to illustrate the merits of steel castings.

In the absence of a national organization definitely responsible for gray iron foundry interests, this work was undertaken by a committee composed of the following: Dan M. Avey, chairman, THE FOUNDRY, Cleveland; A. J. Tuscany, secretary, Ohio State Foundrymen's association, 5713 Euclid avenue, Cleveland; D. M. Houston, International Nickel Co., 67 Wall street, New York; Frank M. Robbins, Ross-Meehan Foundries, Chattanooga, Tenn.; James H. Herron, James H. Herron Co., 1360 West Third street, Cleveland; W. J. Priestley, Electro Metallurgical Sales Corp., 30 East Forty-second street New York; H. Y. Carson, National Cast Iron Pipe Co., Birmingham, Ala.; F. E. Fisher, Bethlehem Steel Corp.; Peoples Gas building, Chicago; W. L. Seelbach, Forest City-Walworth Run Foundries Co., 2500 West Twenty-seventh street, Cleveland; and B. H. Johnson, Cresson-Morris Co., Eighteenth street and Allegheny avenue, Philadelphia.

J. B. Deisher, Rochester, N. Y, who donated his services to the three committees in charge of securing the castings on display, was in active charge at Philadelphia.

Mr. Deisher is a consulting foundry engineer specializing in cupola practice, gray iron metallurgy, malleable practice and sand control. He has had a broad experience in foundry work, including five years on costs and executive administration, ten years practical foundry experience, three years as found expert for the Malleable Iron Research institute and five months as consulting foundryman in Europe for the American Radiator Co. He also was one of the pioneers in the application of pulverized coal to the foundry industry.

To Study Core Baking

On May 1 the American Gas association through its committee on industrial gas research, F. J. Rutledge, chairman, established a fellowship at the University of Michigan, Ann Arbor, to make an intensive study of the many factors entering into the proper baking of cores. This research will be conducted at the department of engineering research under the supervision of H. L. Campbell, associate professor of shop practice. Professor A. E. White is director of the department of engineering research.

Every factor affecting the application of heat in core baking will be investigated and fundamental facts established to determine the advantages of property controlled atmospheres, temperatures and ventilation in core ovens.

Gives Program for Autumn Meeting

The council of the British Institute of Metals has issued a preliminary program of the four-day annual autumn meeting of the institute, which is to be held this year in Liverpool, England. In the course of the 20 years of the institute's existence many provincial centers and foreign cities have been visited, but this is the first occasion on which Liverpool has received the members of this world-famed body of metallurgists and engineers. The proceedings will begin on Sept. 4 with a lecture on "Nonferrous Metals in the Shipping Industry," by F. G. Martin. The mornings of Sept. 5 and 6 will be devoted to the reading and discussion of papers and the afternoons to visiting works of interest in the neighborhood, the Gladstone dock, and a large liner. In the evening of Sept. 6 there will be a reception at the Town hall by the Lord Mayor (Miss Margaret Beavan, J. P.). The meeting will conclude on Sept. 7 with an all-day motor trip to North Wales, during the course of which it is expected that an electric power station and aluminum works will be visited.

Gray Iron Institute

Strikes It s Stride at Philadelphia

New Organization Chooses Directors and Adopts Constitution and By Laws for Governing Exclusive Gray Iron Association — Officers Are Elected

AS A RESULT of action taken at the meeting of the Gray Iron institute held Friday, May 18, in the convention hall at Commercial museum, Philadelphia, the movement fostered by various groups of gray iron foundrymen to unite the industry in a co-operative campaign to promote its interests now is launched on a permanent basis. By-laws were adopted; officers, directors and members of an executive committee were chosen and the organization is ready to function as a going concern.

When the meeting was called to order at 10:30 Friday morning, more than 150 foundrymen were in attendance. B. H. Johnson, Cresson-Morris Co., Philadelphia, presided as chairman. After brief introductory remarks as to the purpose of the meeting, Mr. Johnson outlined the early history of the movement to form a co-operative organization of gray iron foundrymen. He described the initial efforts made by eastern and middle western groups and lauded the spirit of harmony displayed by them in subordinating selfish motives and uniting to avoid duplication and confusion. His account of early progress carried the history of the movement up to the date of the organization meeting held in Pittsburgh, March 13.

At this point, Dan M. Avey, editor, THE FOUNDRY, Cleveland and temporary secretary of the organization committee, took up the story of progress. He gave a detailed account of the accomplishments of the Pittsburgh meeting, which included the adoption of a resolution forming the Gray Iron institute and the election of an organization committee of 15.

Walter L. Seelbach, Forest City-Walworth Run Foundries Co., Cleveland, chairman of the organization committee, then explained what had been done by that committee since its formation at Pittsburgh. He spoke in glowing terms of the work of the subcommittees on constitution and by-laws, finance and budget and merchandising, and outlined the accomplishments of a meeting held in Cleveland April 10 when 13 of the 15 committee members attended and at which all committee reports were adopted.

J. H. Bruce, Bowler Foundry Co., Cleveland, chairman of the merchandising committee presented the report of that committee, in which the seven principal objects of the institute are stated and discussed. This report represents such a clear statement of the problems of merchandising that it appears on another page of this issue.

The chairman next introduced Charles F. Abbott, executive director, American Institute of Steel Construction, New York, who presented an unusually clear picture of the value of a trade associations and explained a number of the essential factors in the successful operation of such an organization. He outlined the new economic conditions confronted by industry and showed how it is impossible for individuals to cope with these conditions single handed. The most effective way to meet present day problems of competition, he said, is through the agency of a properly organized association.

Mr. Abbott then assailed the attitude displayed by many manufacturers that their business is different from all others and that ordinary methods will not solve their problems. The fundamental principles are applicable to all businesses, he declared.

The speaker then gave a colorful

B. H. JOHNSON
First vice president
Cresson-Morris Co., Philadelphia.

WALTER L. SEELBACH
President
Forest City-Walworth Run Foundries Co., Cleveland.

A. E. HAGEBOECK
Second vice president
Frank Foundries Corp., Moline, Ill.

H. S. CHAFEE,
Treasurer
Builders Iron Foundry, Providence, R. I.

outline of the remarkable accomplishments of a score or more of organizations which have been unusually successful in enlarging their markets through co-operative effort. After describing how many of these attained success in stimulating sales, he declared there is no reason why the gray iron foundrymen, by pursuing approved and tried methods, cannot achieve the same results. In conclusion he spoke of some of the early problems of his own association.

Following luncheon, the meeting reconvened and adopted the by-laws recommended by the subcommittee of constitution and by-laws. A nominating committee, headed by Walter Wood, R. D. Wood & Co., Philadelphia, brought in a report nominating 15 members to form the first board of directors.

Form First Board

The following were nominated as directors to serve until the first annual meeting which will be called in the fall of this year: J. H. Bruce, Bowler Foundry Co., Cleveland; J. L. Carter, Barlow Foundry Co., Newark, N. J.; H. S. Chafee, Builders Iron Foundry, Providence, R. I.; A. E. Clarke, Des Plaines Foundry Co., Des Plaines, Ill.; J. D. Coltman, Bullard Machine Tool Co., Bridgeport, Conn.; Horace R. Culling, Carondelet Foundry Co., St. Louis; Fred Erb, Erb-Joyce Foundry Co., Detroit; W. J. Grede, Liberty Foundry Co., Milwaukee; A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; A. J. Hartman, United Engineering & Foundry Co., Pittsburgh; John Hartman, Atlas Foundry & Machinery Co., Tacoma, Wash.; B. H. Johnson, Cresson-Morris Co., Philadelphia; Don McDaniel, Hamilton Foundry & Machine Co., Hamilton, O.; Walter L. Seelbach, Forest City-Walworth Run Foundries Co., Cleveland; Edward B. Sherwin, Chicago Hardware Foundry Co., North Chicago, Ill.

Unanimous acceptance of these nominations establishing the board of directors was followed by the adjournment of the meeting and the immediate convening of an executive session of the new board. At this time the following officers were elected : Walter L. Seelbach, president; B. H. Johnson, first vice president; A. E. Hageboeck, second vice president and H. S. Chafee, treasurer. These officers with J. L. Carter form the executive committee in accordance with the by-laws. The appointment of a secretary-manager, which is in the hands of the executive committee will be made at a future date. In the meantime, Dan M. Avey, Cleveland, will serve as temporary secretary.

J. L. CARTER
Member executive committee.
Barlow Foundry Co., Newark, N. J.

Committee Advises Publicity

By J. H. Bruce

IN PREPARING this report the committee on merchandising has come to realize that each of the seven purposes of the Gray Iron institute as set forth in the certificate of incorporation adopted today, is a feature of the problem of merchandising our product. As these purposes are comprehensive, their repetition may be of value: *a*—Promotion of sound business ethics in the industry, based on honor and integrity of its members in the manufacture and selling of gray iron castings. *b*—Collection and distribution of information relative to the manufacture of gray iron castings. *c*—To study new merchandising methods, to strengthen present markets, to develop new markets and to discover new uses for gray iron castings. *d*—Promotion of uniformity in cost accounting. *e*—Research work and co-operation with other research agencies to further improve the quality of gray iron castings and to increase their utilization in industry. *f*—Stimulation by co-operative effort of the use and sale of gray iron castings. *g*—Establishment and maintenance of standards of quality for gray iron castings.

The foregoing clauses to be construed both as objects and powers. It is hereby expressly provided that the foregoing enumeration of specific powers shall not be held to limit or restrict in any manner the powers of this corporation.

A complete report from this committee would cover all purposes and advantages of the Gray Iron institute. As these matters have been presented through various addresses and articles appearing in the various trade and business papers, this committee feels that a complete discussion of these features is not necesary in this report.

It should be apparent that little work can be done along the lines set forth in these seven purposes by any individual foundryman, or by local groups of foundrymen. Any progress must be the result of persistent and intelligent work on the part of some one individual to whom for want of a better title we shall refer hereafter as the manager of the institute.

Selection of the proper man for this position is a matter of major

importance. The amount of progress and the quality of the work done will depend largely on his ability and conscientiousness. He will need the support and co-operation of every member. As the work progresses undoubtedly he will require paid assistants to work under his direction.

Merchandising activities of the institute can be grouped under three heads: Research, foundry facilities, sales and publicity.

Research should cover improvement and standardization of our product. This committee recommends that work on research shall be done under the direction of the research committee with the idea of obtaining usable and practical information for the members at the earliest possible date. Standardization work should be done first.

In carrying on this research work full co-operation should be sought with existing agencies. Much information of specific interest to gray iron foundrymen is available, notably that which is reported is a bibliography recently completed by the American Foundrymen's association.

Co-operating with other agencies, full cognizance should be taken of the committees now existing in various technical societies. These committees should be extended assistance and the work should be centralized to prevent waste and duplication of effort.

One of the reasons for the present status of the gray iron industry is the variation in quality between the product of various foundries and the absence of standard specifications for the various types of gray iron and its alloys. To satisfy the immediate needs of the gray iron industry this research work could well cover the separation of gray iron into a number of grades, each with its proper designation, which will be recognized as a standard by each member of the institute.

Establish Confidence

Physical qualities desirable for certain requirements under each grade should be stated. The type of casting for which each grade is particularly suitable and the general characteristics of each grade should be given.

Heavy castings require a certain structure and light castings require different grain structure. Castings designed to resist high temperatures or high pressure conditions are different from each of these and cannot be poured from the same metal nor at the same temperature. The sooner we realize and make these facts known to the buying public, that much sooner will we re-establish confidence in gray iron. Fortunately alloys now may be made which will provide castings to meet different requirements although all the metal may be produced from the same type of melting unit and the difference affected by manipulation.

Investigation of foundry facilities properly should come within the province of the Gray Iron institute in connection with its merchandising activities. It may be that consolidation of existing foundries and perhaps the inducing of manufacturers now operating foundry departments to purchase their requirements could be affected by presenting all the facts in relation to gray iron conditions at present. Beneficial results not only to the foundry industry, but to the entire business structure of the country would accrue from the elimination of surplus, idle and unprofitable foundry facilities.

Joseph H. Bruce author of this paper and chairman of the merchandising committee set up by the organization committee of the Gray Iron institute is president and general manager of the Bowler Foundry Co., Cleveland, one of the oldest establishments of its kind in that city. Founded in the early sixties by Bowler & Maher, four years ago the property with many others was appropriated for the western approach to the new terminal station. At that time the Bowler organization moved into a new, capacious and modernly equipped plant at East 49th street. Several years ago Mr. Bruce assisted at the organization of the Ohio State Foundrymen's association and has taken a prominent part in its activities since that time.

As a first step, statistics should be compiled to show: The capacity of existing gray iron foundries in tons; the tonnage produced by these foundries during each of the past four years. Simple subtraction would show the amount of additional tonnage that could be produced with present facilities. Another feature that would help to clarify the situation would be a presentation of the amount of capital invested in existing gray iron foundries and the average percentage of earnings over the past four years.

These figures would show the present status of the gray iron foundry industry and not simply some person's opinion. They might convince owners of some unprofitable foundries that the future does not hold any possibilities and that the closing of their plants would be advisable. Consolidation best could be discussed and advocated by a third party such as the manager of the institute. Where possibility of consolidation exists, he could be of great assistance in the negotiations. Where new gray iron foundries might be contemplated, these statistics undoubtedly might be instrumental in many instances in causing the plans to be abandoned.

Sales and Publicity

The manager of the institute could cause many foundries that are operated as manufacturing departments to be used for other purposes. This could be done by presenting to the owners the condition of the industry. By stressing the lower costs possible in jobbing foundries, due to a more balanced production than is possible in most foundries operated as adjuncts of manufacturing concerns.

Sales and publicity would cover the strengthening of present markets, development of new markets, new products, adoption of a code of ethics or of trade customs clarifying the relations between buyer and seller and the study of merchandising methods. Under this heading would come the use of advertising to set forth the advantages of gray iron and the defense of gray iron in all cases against unfavorable publicity.

Possibilities in these activities are apparent to all. Amount of work to be done along these lines is limited solely by the amount of co-operation given the institute by its members and by the funds available for this purpose.

The most important subject for discussion at this time is the form in which the institute is to be presented

to the public, to prospective members and to the trade. Value of membership in the institute from a merchandizing standpoint depends largely on the manner in which it is presented. This subject might be designated the certification of product. The foregoing statement of the purposes of the association fully covers the ground from a foundryman's standpoint, but from a merchandising viewpoint it is of no particular value.

Under the seal or trademark of the institute the members are urged to use the following or a similar statement;

MEMBER GRAY IRON INSTITUTE

An organization of gray iron foundries formed for the purpose of improving their product through research, through the standardization of product, through the adoption of recent improvements in the art and through rigid adherence to specifications.

This public announcement of the purposes of the institute will have to be revised carefully. It is offered simply to illustrate the thought of the committee regarding the manner in which the institute should be presented to the public. Statements of purpose will be of great assistance in selling the institute to prospective members. Right to use the seal of the institute would be of great sales value since it confers prestige upon a member and gives to his customers additional confidence due to the fact that the member has subscribed publicly to the ideals and to the rank of the Gray Iron institute.

If the grading of gray iron can be accomplished successfully and if a pamphlet can be issued by the institute covering this work, this grading in conjunction with the certification of the product will represent in the minds of the committee the greatest progress that ever has been made in the merchandising of gray iron castings.

British Institute to Meet in Leicester

THE annual convention of the Institute of British Foundrymen will be held this year from June 12 to 15 at Leicester. The president elect S. H. Russell of the firm S. Russell & Sons, brass and iron founders will be inducted into the chair with the usual ceromonies at the opening meeting Wednesday June 13, and will deliver his presidential address.

In accordance with long established precedent the technical sessions will be held in the morning while the afternoon and evening periods will be devoted to visits of inspection to the various interesting plants and other establishments and to a variety of social functions.

The following list of papers will be presented and discussed at the two morning sessions June 13 and 14: Annual exchange paper of the Association Technique de Fonderie de France entitled "A Study of the Phenomenon of Contraction in an Iron Casting," prepared by Maurice Servais; "Malleable Castings," by W. T. Evans and A. E. Peace. Ley's Malleable Castings Co., Ltd., Derby; "Steel Castings for Severe Service," by John Howe Hall, the exchange paper of the American Foundrymen's association; "Aluminum Casting Alloys," by G. Mortimes, William Mills & Co., Birmingham; "The Soundness of Rammed Molds," annual exchange paper of the Association Technique de Fonderie de Belgique, by Ivan Lamoureux, vice president of the Belgian Foundrymen's association; *Iron Foundry Costing*, by W. R. Wintle, Sheepbridge Coal & Iron Co., Ltd.

By special arrangement with the proper authorities the visitors will be taken through the following plants: Centrifugal castings plant of the Stanton Iron Works Co. Ltd.; British Thompson-Houston Co., Ltd.; Rugby; Wadkin & Co. Ltd., Leicester; Ley's Malleable Castings Co., Ltd., Derby; the chief mechanical engineer's department of the London, Midland and Scottish Railroad Co.; Rolls-Royce, Ltd.; Herbert Morris, Ltd.; John Taylor & Co., bell founders. A visit to Loughborough college also has been arranged.

Visitors will be tendered a civic reception on the evening of June 12 and the mayor of Leicester will deliver the welcoming address at the opening of the morning session June 13. A number of social functions have been arranged and a special program has been prepared for the ladies. At the close of the convention the party will be taken for an excursion to Charmwood Forest on the afternoon of Friday, June 15.

Engineers Consider the Properties of Metals

More than 850 members and guests of the American Society of Mechanical Engineers participated in the spring meeting of the society at the William Penn hotel, Pittsburgh, May 14-17. Activities on the four days consisted of simultaneous technical sessions, committee meetings, plant inspection trips, dinners, a smoker and a banquet.

Officers nominated and to be elected by mail ballot were as follows: President, Elmer A. Sperry, chairman of board, Sperry Gyroscope Co., Brooklyn, N. Y.; vice presidents, William Elmer, special engineer, Pennsylvania railroad, Philadelphia, Robert L. Daugherty, professor of mechanical and hydraulic engineering, California Institute of Technology, Pasadena, Calif.; Charles E. Gorton, chairman, American Uniform Boiler Law society, New York; managers, Charles M. Allen, professor of hydraulic engineering, Worcester Polytechnic institute, Worcester, Mass., Robert M. Gates, manager, industrial division, Superheater Co., New York, and Ely C. Hutchinson, president and general manager, Pelton Water Wheel Co., San Francisco.

Nonferrous alloys was the subject of one of the simultaneous sessions on Thursday morning. A paper "Mechanical Properties of Aluminum Casting Alloys at Elevated Temperatures," prepared by R. L. Templin, chief engineer of tests, C. Braglio, testing engineer, and K. Marsh, chief of pyrometric division, respectively, Aluminum Co. of America, Pittsburgh, was presented.

Data were presented to show how certain effects of temperature on aluminum alloys susceptible to heat treatment may be appreciably modified by still further heat treatment or artificial aging. A method was indicated for applying experimental results from a single lot of specimens to commercial product average values, together with a complete table of recommended tensile property values at various temperatures for the alloys tested.

A study of tin-base bearing metals, comprising the results of metallographic and mechanical tests on a series of tin-antimony-copper alloys containing up to 10 per cent antimony and 8 per cent copper, was presented by O. W. Ellis and G. B. Karelitz, research department, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Relationships between the composition, microstructure, hardness, and compressive strength of these alloys were given.

Unexpected Variations *DOMINATE* Steel Casting Practice

By F. A. Melmoth

Part I

EVEN in these days of acute competition, when the financial side of steel castings production admittedly must be perpetually to the fore in the minds of all producers, it is the ambition of every foundryman to produce the *perfect* casting. More than this, to have also an exact knowledge of what went to produce it, so that control and supervision, coupled with exact information, can repeat, again and again, the cycle of operations with unvarying success.

After a good many years' experience, the author has been forced to the conclusion that the dominating feature of steel castings is their inherent tendency to unexpected variation. Regular lines of procedure are laid down as the result of research and experience, but in spite of all precautions, occasions arise when all expectations meet with disappointment and production does not proceed to schedule. It is, of course, just this capricious behavior which adds an intriguing piquancy to steel castings investigations, but to those of us who are responsible for costs of production, as well as quality, this represents poor consolation. Our invariable question is, why do these things happen?

Value Is Limited

Light has been thrown on many of the dark places associated with steel production by the immense advance which has taken place in the application of scientific knowledge to practical needs. Research into the phenomena associated with steel has progressed at a rapid rate, but in the author's opinion, its value really is limited by the degree to which it is adapted and applied to the practical problems of the industry. Research for its own sake is undoubtedly a high ideal, and has in the past added richly to our stores of knowledge, but to the producer of the world's goods no matter in what form, only that which is practically applicable, is of value.

Although he hopes for contradiction, based on facts, the author definitely feels that in many ways the foundry industry as a whole has lagged behind the rest of the metallurgical trades, in the adaptation of scientific knowledge. He would ask, however, is this our own fault? Is it not equally true, at any rate, that the problems of the foundry have not been thought of sufficient interest or importance to merit the close investigation rendered to other branches?

There is no doubt whatever that the attitude of disregarding the foundry and its needs is vanishing. A perusal of modern foundry technical publications, papers submitted to various foundry associations, etc., will, the author thinks, go far to prove this statement. The application of scientific knowledge to the production of gray iron, for instance, would appear to have been attended by great success, and remarkable advances have been made.

Attitude Is Improving

Where the steel foundry is concerned, the attitude adopted appears decidedly to be improving, and no doubt similar beneficial results may be looked for.

The factors influencing the production of a steel casting to the greatest extent may be said to be:

The human element; the influence of the various molding operations; the metallurgical behavior of the steel in the form of a sand casting, and the heat treatment after casting.

The author proposes to state his impressions of these influences, and to consider where, in his opinion, certain lines of investigation exist which offer profitable results.

The influence of the human element varies according to the procedure adopted. In large production of repetition castings it seems obvious that posibilities occur of largely eliminating some of the more variable effects of personal manipulation. The standardization of method, introduction of machines, and so on, all tend to reduce these points at which individual ideas can affect the ultimate article. In the production of castings of a type suitable for repetition manufacture in large numbers, the author most wholeheartedly would agree with constant attempts to eliminate at any and every point possible, the effect of the human element. By this he means

Manages Steel Foundry

THIS is the first section of a paper which was presented at the convention of the American Foundrymen's association which was held in Philadelphia, May 14 to 18, and gives an insight into the various factors affecting steel castings production.

F. A. Melmoth, author of this paper, is a native of Sheffield, England, and received his technical education at Sheffield university in the department of applied science. For his work there he was awarded an associateship in metallurgy with the Mappin medal of honor in 1913. His early works experience was gained at Brown Bayleys Steel Works Ltd., Sheffield, the latter years of which were spent in the research department and in practical steel production by open hearth and electric methods. Mr. Melmoth later specialized on steel foundry production with firms in the south of England. He was appointed steel maker and metallurgist to Lake & Elliot Ltd., Braintree, and coincidently served with the National Steel Foundry Ltd. of Scotland in a consulting capacity. Following this work he was given full charge of the foundry of Lake & Elliot Ltd., when he obtained experience in management of the production of steel, malleable and gray iron castings. Two years ago Mr. Melmoth was appointed to his present position as manager of the steel foundry of Thos. Firth & Sons Ltd., Sheffield.

F. A. Melmoth

the introduction at any point, of the individual idea, not according to previously laid down plans. Such schemes centralize the actual higher grade knowledge required to those responsible for the successful running of the shop, and the operators become semi-mechanical performers of predetermined operations. The skill and training demanded of the operator is of a different type, and more easily and quickly attainable.

Is of Different Type

Unfortunately, a large volume of business in steel castings is of an altogether different type. It calls for individual experience and skill in almost every one of its many operations, and the human factor becomes often the deciding one between success and failure. Such castings doubtless always will be required, and therefore, the question of the individual skill of the future operative is a matter of vital importance. It is significant that in almost all presidential addresses of the Institute of British Foundrymen, reference is made to the training of apprentices, and a knowledge of the skill demanded to handle some of the present-day foundry propositions emphasizes the importance of the question.

Realizing then the inevitable influence of the personality of the operative, what are we to consider necessary to him in the way of knowledge which will enable this influence to be of a more beneficial nature? Skill in the use of his tools, and mechanical efficiency, he can gain by experience, and a carefully supervised apprenticeship to his trade, but will this enable him to keep step with the application of modern knowledge to his job? The author does not think so, and finds it difficult to believe that satisfactory molds for steel, satisfactory handling of the produced castings, or satisfactory after treatment, can be assured if the man employed is not influenced by a knowledge of the material he is handling.

Obviously, the author is not suggesting that it is necessary for an operative to be a skilled metallurgist, which would be an absurdity. However, an increased knowledge of the main known facts regarding steel could not but help, and would guide the application of his craftsman's skill into correct channels. It would make understandable to him a vast amount of literature regarding his trade, which perhaps now is a closed book to him, and thus widen his opportunities of acquiring still more knowledge.

There is a definite possibility of an acute shortage of really skilled moulders in Great Britain, should there be any marked increase in the present demand for castings. It seems, therefore, all the more necessary that those available should have the widest and most complete knowledge possible. They quite possibly might come to be the nucleus of knowledge and experience round which future production schemes will be designed.

A further important fact incidental to the possession of a wider knowledge by the molder is that of the corresponding rise in the status of his trade certain to follow. The foundry industry does not appear ever to receive acknowledgement of the ability and skill demanded, although, in the author's view, the real molder represents industrial skill of the highest order. It must be good both for the individual and the industry generally, that the intellectual standard should be raised, and this doubtless would be followed by a keener desire among boys to join the ranks of foundry workers; many of whom today avoid doing so because of a mistaken idea of its being work of a low grade, and dirty, compared with other skilled branches of trade.

Therefore, the author considers that the curriculum for foundry apprentices always should include a course of elementary metallurgy. This can be of a simple nature, sufficient to produce a correct appreciation of the behavior of metal in sand molds, and precautions necessary to guard against the ill effects on the casting of the natural occurrences during its cooling period, and to give significance to the related and mutual effects of the metal on the material of the mold.

Other Information Given

Of the necessity for machine drawing, mechanics and elementary physics it is hardly necessary to speak. These are part of any syllabus designed for our apprentices. In Sheffield golden opportunities exist for the acquiring of all the necessary knowledge outlined. Apprentices are encouraged by most employers to take advantage of these facilities and merit is recognized. The university and education authorities have shown real interest and no excuse exists for any apprentice who fails to obtain for himself modern knowledge, and that necessary little extra which lifts him out of the common ruck.

It will be seen from the foregoing that the author's opinion is that for this class of work we should admit the great influence of the operative, and then by satisfactory training endeavor to guide that influence so that it may become less of a variable.

No matter whether produced by repetition methods or otherwise, no success is possible in a steel casting unless the method adopted is the result of careful consideration. The author feels that it is impossible to lay down rules applicable to each and all of the infinitely variable types of article demanded as castings. Each one must be considered as a separate entity, offering its own problem for solution. However, it is probably a fair statement to say that more castings are spoiled by variations of a mechanical nature than by any other means.

Design Is Important

All foundry men realize the importance of correctly planning a job, deciding its position of casting, the placing and size of its runners and feeding heads, etc.

Leaving aside the question of design, in which foundry opinion should be sought, but often is not, the first point considered is the making of the pattern. A great deal of the ultimate success of the casting depends on the way in which this is made. Yet, how often is a founder supplied with a pattern made without consultation with him, and probably by a patternmaker who has had no experience of the particular metal now demanded, or the nature of the materials used to make the molds? In the author's opinion the closest co-operation between patternmaker and molding shop is called for on all jobs. The false economy of stinting the cost of patterns, the using of poor material, or by so-called economic design of pattern involving the foundry in a risky position or method of molding, all are realized by most foundry executives as being regular happenings.

In repetition work, no such occurrence is really possible, as the number from and ultimate value of the order permits of free spending on pattern equipment. It is realized that security and lack of variation, not to mention rate of production, give a more than adequate return. However, as previously mentioned, vast quantities of steel castings have to be made which cannot be described as being of a repetition character. Yet it must be realized that often an even higher standard is demanded from these jobbing castings than from repetition ones. For example, take the case of steam pressure castings, turbine castings and similar castings. Accuracy of shape, perfect soundness, the exact placing of all cores, are matters of infinite importance, and yet design may alter considerably from order to order.

When the significance of all these

points is realized, one would imagine that patterns for such parts would be of the best, and designed to mold and core up as the result of collaborated thought between patternmaker and molder. Is it not often the case that the molder is supplied with a pattern so designed that, owing to difficulties of withdrawal, or the insertion of cores, he is driven to mold in a position not entirely favorable to the production of a perfect job?

This then is surely the first of our points, that in all cases the design and type of pattern supplied shall be the result of close co-operation between pattern shop and foundry. That the ultimate casting, both from quality and cost of production points of view, shall be the primary consideration. By this means, perhaps, one or more of our variables may be reduced in its number of occurrences and more regular castings result.

Preparation of molding materials is the next process of a mechanical nature often involving possibilities of variation.

Here again we necessarily must define sharply the repetition production requirements from the needs of the shop handling a product of a varying nature, both as to size and type.

In the former, the author considers it quite possible to arrange matters so that serious variations are a remote possibility. Assuming the articles made to fall within a reasonable range of size and weight, no great differences in sands required are likely to occur. Therefore, given a consistent supply of the basis sand, and each consignment subjected to careful testing and examination before use, mechanical means and supervision at various points can be adapted to insure regularity.

Possibilities for Variation

However the case of the shop handling a large variety of work of widely varying types is different. The material suitable for the small plain casting may be hopeless for the larger and more intricate one and for heavy jobs involving massive sections of metal, an altogether new type of molding material may be called for.

This involves a multiplicity of molding sands, and in the author's opinion, opens up one more serious possibility of variation. For a shop of this type increased supervision costs, as against repetition work, are quite normal.

The author proposes to take the case of a British shop making a widely varying type of product and to show the classes of material in use in this particular case. It must be remembered that practice varies a good deal from shop to shop, and different materials may be in use elsewhere. The work may be divided into three classes: Small green sand castings; medium weight castings in dry sand; heavy castings, usually made in composition.

For the small green sand castings either a naturally bonded sand, such as Belgian, or equally satisfactory material found in Great Britain, or what may be called a synthetic sand, may be used. The latter is merely a suitable grade of silica sand, milled with the necessary amount of refractory clay to produce sufficient bond for easy working, without seriously reducing its permeability to gases. In either case the possibilities of variation are similar, and are along two main lines.

Must Consider Sand

Extreme refractoriness is not a vital feature, as the small sections involved do not subject the mold to high temperature for prolonged periods. The main lines of possible variation are moisture content and porosity. Where sand consumption is regular the former is easily controllable by the instituting of regular moisture tests on the product of the sand mills.

Porosity, or permeability to gases, may be affected in many ways. The shape of the grains of sand is important, and obviously, the more nearly spherical the better. The author believes this to be much more important than their actual size. Shapes which encourage the close interlocking of sand grains, already thinly covered by an envelope of bonding clay, naturally will tend to produce a dense compact mold, likely to result in unsound castings.

An excessive amount of the bonding material also will produce similar results, as the natural pores existing between the rounded grains of silica will, under the influence of packing together in molding, tend to fill up with impervious clay. Excessive moisture also contributes its quota toward reducing mold porosity, as it is realized that a wet sand tends to produce a close hard mold, through which the passage of gases is difficult.

To reduce possibility of variations, due to sand in such castings, the points following are important:

Grain size and shape determinations on the silica portion of the sand; close control of moisture content; careful milling of the sand to distribute the bonding material in the form of the thinnest possible envelopes round the sand grains; no heavy milling, likely to break up the original rounded grains of silica, and careful control of the amounts of bonding clay used, to avoid excess.

Supervision of the enumerated points can be made quite easily a matter of routine, and variables in these conditions are most likely to occur in the actual use of the sand itself, not due to its preparation. In this connection the human factor previously dealt with comes into operation, and may upset most carefully made arrangements. As an instance, it is not unknown for a molder, finding such a sand on the dry side, to add water on his own initiative. The previously carefully arranged quantitative preparation then stands for nothing, and a variable has been introduced, often with dire results.

Molds for small green sand castings are made on molding machines of either squeezer or jolt ram type, and, as it is agreed that hardness of mold can affect the ultimate result in the casting, a further variable becomes possible. This can be largely overcome by proper arrangements, in the squeezer by the use of a sand frame, limiting the amount of sand, and in the jolt ram by limiting the jolts to a number proved to give a satisfactory mold. Owing to the impossibility of sufficient supervision to absolutely insure this, however, there is little doubt but that a number of cases of variable results can be attributed to this point alone.

Feeding Heads Not Used

Castings of the green sand type are of thin section and often possess a number of bosses or local thick sections. The use of nails often is resorted to, to assist soundness in these places. Owing either to their inaccessibility, or to question of cost involved in their removal, feeding heads are used as little as possible in such castings. Slight variations from regular fixed routine in the use of chilling devices, such as nails, almost invariably are followed by trouble with the castings. The use of dirty or rusty nails, or more often condensation trouble due to allowing a green sand mold, containing nails, to stand a period before casting, inevitably produces unsoundness in the parts affected.

Most green sand facings for steel castings are extremely open in nature, and do not call for a great amount of venting of the mold itself, when the mold is small; but the question of dealing with gases evolved from cores during casting does appear of serious importance. The author has experienced many serious troubles at times which were proved to be entirely due to lack of care in permit-

ting free egress from the mold of gases evolved from cores. It appears rather futile to go to the trouble to produce a well vented core, and yet when inserting it into a mold to fail to make such arrangements as will allow these vents to function, with the consequence that blown castings result.

Summarizing the variables for small green sand castings therefore, assuming the provision of correctly produced sand, the following are obtained:

No correction of moisture content should be permitted at the discretion of the operative; the ramming conditions should be as consistent and fool proof as possible; any chills or nails should be perfectly clean; the molds should be cast as quickly as possible after closing; and vents from cores should be free, and carried outside the mold.

Influence of the nature of the backing sand is considerable on green sand castings. It has always appeared to the author that it is not logical to insist on an open porous condition of the facing sand, while using a close, impermeable backing, likely to ram up like a brick. He feels sure that many cases of sponginess in castings safely might be attributed to this condition, and therefore, if variables are to be eliminated as far as possible would suggest a regular periodic examination of all heap sand, and its treatment if necessary to keep accumulated silt, etc., within safe limits.

In medium size dry sand castings, sands in use are similar in nature to those for the previously mentioned green sand castings with the probable addition of small extra amounts of bonding material, and likely a small content of some organic binder, to give a firm mold face after drying. With the exception of moisture content, all the points previously noted as needing careful attention if variations are to be avoided are just as important.

These molds are called upon to stand up to heavier sections of metal, which means that the mold face is at a high temperature for a more prolonged period. The question of refractoriness becomes of immediate importance. If the degree of refractoriness is low, fusion of the sand at the mold face is likely, with a resulting casting expensive to fettle. In bad cases, also, fused portions of the sand may enter the metal as a liquid slag, and probably ultimately come to rest in a part subjected to machining. Rejection of the casting results.

The most likely variables entering into the manufacture of the molds for this class of medium size castings are:

Sand too close, thereby preventing the free passage of gases.

The use of too much binder, either of the clay grade or organic type, thus giving a mold hard and impermeable.

The closing of such a mold not completely dried with the resulting accumulation of steam in the mold cavity.

The possibility of rusty or dirty chills or nails.

Runners not properly covered with facing sand, so that old and weak sand is permitted to come into contact with the stream of metal.

Drying at such a high temperature that the mold face is practically burnt. The binding agent is thereby rendered almost inert and the face of the mold is friable and weak, offering little resistance to the erosive action of the metal passing over it.

The existence in the facing sand of fusible constituents lowering its refractoriness, which, under the influence of greater weight of metal and high temperature, results in partial fusion and the burning on of sand to the casting.

In British practice most large heavy castings are made in some form of molding composition, it being generally accepted that normal molding sands with a silica base are not fully up to the job of withstanding the effect of large masses of steel being poured over and on to them.

These compositions are often made by the foundries concerned for their own use, and there is no doubt that many different mixtures are in use. The mixtures vary principally in relative quantities of the constituents, which, generally speaking, may be said to be the following: Old crucible pots; used fire bricks; fireclay; sand and coke dust.

These are crushed in the required amounts, and the resulting mixture moistened to the necessary extent to produce a satisfactory bond for molding purposes.

All the points requiring consideration in ordinary molding sands are of at least equal importance in these compositions. Grain size and shape, to insure porosity, are of outstanding importance, but the author would give first place to refractoriness. For the lighter classes of steel castings, where the mold face is not subjected for long periods to high temperature and at the same time to heavy superimposed masses of liquid steel, refractoriness is not so vitally important.

For the heavy types of casting, however, any shortcoming in this respect results in extreme difficulty in the fettling shop. Therefore, the variations likely to be introduced via the mold, are the same for heavy castings as the lighter ones, with the added tendency to increased mold fusion with consequent adherence to the casting. The materials from which such compositions are produced must be chosen most carefully, and hand picked for the removal of unsuitable constituents such as slag, etc., which would tend to lower the refractoriness of the resulting mixture.

To produce an improved skin on the casting, these molds almost invariably are painted before drying. The constitution of the paint used is of importance, most particularly from the standpoint of refractoriness. Obviously, it is in complete contact with the liquid steel forming the casting, and a low fusion paint will result in its partial or complete liquefaction, the slagging result being carried often to dangerous places on the casting itself. Therefore the paint used should be of a highly siliceous and refractory nature, and the author has experienced serious variations in the character of the produced castings definitely associated with variations in the paint used.

It is not uncommon for these large molds, made in composition, to be tarred after their removal from the drying stove and while still at a high enough temperature to burn out all volatile constituents of the tar.

In these cases, it is necessary to remember that an excess of tar, or tarring at too low a temperature, is likely to induce a state of affairs which almost inevitably will produce porous castings.

The most likely factors, attributable to the mold materials, likely to cause variation in the production of molds for this class of work, might be summarized as follows:

Composition too close, the grain size being too fine to permit of free passage of mold gases.

The use of too much clay bond, resulting in the same disadvantage as the first mentioned.

The accidental introduction into the mixture of some less refractory constituent causing fusion of the composition under the influence of high temperature and liquid steel pressure.

The use of a paint for the molds of a not sufficiently refractory nature.

Tarring of molds, either excessively, or at too low a temperature, inducing increased gas formation during casting.

There are, of course, numbers of possible variables common to all these classes of casting, such as accuracy of molding tackle, precautions to insure accurate coring up, adequate cramping or weighting of boxes, control of speeds and temperature of casting and so on, and attention to all these points is desirable if consistent production is to result.

Reviews Progress in Cast Iron Metallurgy

By Dr. Richard Moldenke

EXAMINING present-day operating conditions in their effect upon the quality of the castings produced, the foundry finds itself still suffering to a considerable extent from the deterioration of materials which had taken place during the early part of the last decade. With the bulk of the pig irons going into steel in those years, foundrymen were forced to increase their scrap percentages to previously undreamt figures. Repeated remelting of such irons without the beneficial dilution of the contained sulphides and oxides by copious pig iron additions only could result in the serious and cumulative deterioration of the merchantable scrap. Therefore, the scrap iron piles of today are certainly not as good in composition and melting value as was formerly the case, and need increasing care in scrutiny and classification for safe use in the foundry mixture.

A deteriorated scrap pile is, however, a condition that could not be avoided under the world conditions existing. The iron foundry, instead of returning to the pig and scrap ratios in vogue formerly, as pig irons became available again, still retained the high scrap percentages in even their best mixtures.

Desulphurize Cast Iron

Since a bad situation sooner or later brings about the discovery of a remedy, a method of desulphurizing cast iron by chemical means was developed which has put into the hands of the foundryman a remedy easily applied. This with high temperatures in melting to encompass some degree of deoxidation at the same time overcomes the bad effects of using the scrap of today.

The question of quality in pig irons is becoming a much mooted one. A sharp line has to be drawn between pig irons intended for the foundry, and those going into the making of steel. In the former case, whether it be the reoxidation of the iron sponge, the oxidation of drops of metal falling before the tuyeres, or whatever may be responsible for the existence of dissolved iron oxide in the pig metal, the greatest possible attention should be given to holding this dissolved oxide down to a minimum. Whatever melting process is used in the foundry will be oxidizing in nature and only will aggravate the difficulties coming from oxidation already existing. Hence, the importance of starting out with the best of pig irons when good castings are to be made. Such pig irons cannot be made without plenty of coke, certainly not with hard driving and when the furnace is running irregularly. The greater the iron oxide content of the molten metal the higher the freezing point it has, and the narrower will be the range between the pouring temperature and solidification of the metal.

Is Exchange Paper

THIS article is abstracted from a paper which was presented in behalf of the American Foundrymen's association at the Congrese Internacional de Fundicio or International Congress of Foundrymen which was held at Barcelona, Spain, from April 11 to 14. The author, Dr. Moldenke, is a foundry consulting engineer, residing at Watchung, N. J.

Pig irons intended for steelmaking need not receive the extreme care and attention desirable for foundry pig irons, for every refining process used to convert the irons into steel eliminates the constituents not wanted in the final product by oxidation. That there are such operating differences between pig irons intended for foundry use and those of steelmaking evidently is not known to all blast furnace men—other than the differences in composition ranges. The foundryman slowly is beginning to realize that he must have a workable and reasonably accurate method of testing the pig irons offered him, in addition to ascertaining their composition. Not until then can the question of quality pig iron, in fairness to both furnace and foundry, be made one of price differentiation between the good and the inferior products of the blast furnace.

Fuels used for foundry melting and whatever heat treatment may be given the castings made, are today again about as good as ever. Some improvement is possible in the production of foundry by-product coke. This should not be made a side-issue to the recovery of the by-products, but given the higher temperatures and longer time necessary for first-class foundry coke. It will be harder, less porous, catch fire less easily, and remain in larger pieces than has usually been the case so far. Simply the matter of small and large pieces of coke for melting in foundries where the strictest economy is practised, means the difference between cold and hot molten iron.

So far as coal for furnace melting and annealing is concerned, an abundance of most excellent material is available, and with the increasing use of powdered coal in individual installations and comprehensive systems, all the advantages of gas-firing are readily obtained. Fuel oil, while used successfully in open-hearth furnace practice and in heating, should be employed with caution in cupola and air furnace melting, as the enormous volume of water vapor from the high hydrogen content of this fuel in direct contact with molten iron may oxidize it heavily, render it sluggish and prove inferior for quality castings.

Study Molding Sands

One of the important developments in the production of castings today, is the study of molding sands. Much research work on molding sands has been done, much information has been collected and many tests have been devised. It would seem desirable to stress more strongly the real objective of such investigations; namely, the determination of the composition of ideal molding sands for different kinds and classes of castings, so that these sands may be produced synthetically, at a cost not prohibitive to their use in ordinary foundry practice.

The idea of making molding sands artificially is not new, for one has only to turn to Sweden, practically bare of good molding sands, to see the application of clay to the heaps of weak sand to give bonding strength and make the resulting mixture serve the molder satisfactorily.

In the study of molding sands, a

parallel issue should not be neglected. This is how to beneficate natural molding sands to improve their quality and give them longer life. Reasonably good natural molding sands should not be discarded without exhausting every means to improve them, and the producers of the sand should be helped in every way to guard and enhance their investment.

Gives Explanation

A comparison of the old-time core room with the present-day establishment shows a difference as between night and day. So far as it bears upon the quality of the castings made, with selected sands, suitable binders, and mechanical mixing, cores are produced that are accurate. With core drying and baking ovens of modern nonconducting, thin-wall construction, electrically heated and under perfect control, there is no excuse for defective work due to inferior cores.

Recent achievements in the improvement of cast iron, at least partially explain why marked strength increases are obtained without serious reductions in the carbon content of cast irons. The explanation is based upon the influence of temperature upon the physical condition of the graphite precipitated during the change in the iron from the molten to the solid phase. It must be patent, that the slower the cooling, the larger the crystals formed in a solution of a given material which is sufficiently concentrated to contain nuclei of that material as starting points of such crystals. The faster the cooling rate, or the shorter the interval of time in setting, the smaller the crystals of the resulting solidified mass. Graphite forms no exception to the rule. Under ordinary melting conditions, with slow cooling of the molten carbon-iron solution when poured into dried sand or even heated molds of a low heat-conducting power, the crystals formed will be coarse. The same iron poured into metal molds of high heat-conducting power will contain any graphite precipitated in the form of fine crystals.

Naturally, to obtain any graphite crystals at all, there must be present or formed, graphite nuclei or starting points for crystals in the liquid metal either before or during the period of setting. The size of the crystals will depend upon how much time elapses between the commencement of crystal growth out of the nuclei of graphite, and solidification. The importance of the recent research developments lies in having located an abundance of microscopically small graphite nuclei in gray cast iron, melted under ordinary conditions of melting and superheating. These nuclei serve as the starting points of coarse crystal growth when the metal freezes and give a weak cast iron.

By superheating the molten metal to extremely high temperatures the graphite nuclei disappear completely by solution in the iron and in the subsequent cooling the growth of large graphite crystals cannot take place as there are no starting nuclei present. Only when considerably cooled—in fact, actually supercooled below normal freezing ranges—will graphite nuclei form again. When graphite nuclei do form in such a supercooled molten iron, the temperature will have dropped so close to the freezing point that there is time only for the formation of fine crystals, and a strong metal results. An iron melted under conditions of superheat far beyond the ranges of ordinary practice may give castings much stronger than the same iron melted with the ordinary degree of superheat.

This may be proved by melting a charge of gray cast iron in a crucible or in a resistance electric furnace. When just liquid, a test piece is poured with one end against a chill. Micrographs made of the hard and the soft ends of the casting will show the graphite nuclei in the white portion of the metal, and the large graphite crystals in the gray. If the remainder of the charge is heated up a hundred or more degrees, cooled down to the first pouring temperature and corresponding test pieces and micrographs made, the graphite nuclei in the chilled portions will be found to gradually disappear as the high temperature ranges are reached. In the soft portions, similarly, the crystals of graphite will have become smaller and smaller. If enough metal were used to enable the making of tensile test specimens in sand molds in each case, the strengths will be found to go up as the degree of superheat rises.

Strength Increases

There is doubtless an additional explanation for the strength increase incident to melting under conditions which give high degrees of superheat. At temperatures equal to those of molten steel, an iron containing over 2.50 per cent total carbon and possibly as much silicon, with manganese up to 1.00 per cent hardly can tolerate the presence of dissolved iron oxide. This material will be reduced, just as when adding ferromanganese to a blow of bessemer steel to deoxidize it, and a thoroughly deoxidized cast iron will gain correspondingly in quality. Even in ordinary foundry practice, it is known that melting hot means less sulphur picked up from fuel, less chances for blowholes and generally better castings. The rule is to pour as hot as the sand will stand it. Foundrymen know that the hotter the metal, the deeper the chill, especially when running low silicon irons. Doubtless the disappearance of the graphite nuclei under conditions of extremely hot melting helps to retard the formation of large graphite crystals, otherwise the case with lower degrees of superheat, and therefore the metal can chill deeper.

However, it does not follow that when operating under low degrees of superheat, soft iron will result because of the ready growth of large crystals of graphite from the nuclei present in the molten metal. Melting cold may result from an unduly low fuel bed, and this causes an oxidation of the iron. This, in turn, results in a higher freezing point, reducing the normal interval of time for crystalline graphite growth before the metal solidifies and perhaps hard iron. In the case of air furnace melting, cold molten iron does mean softer metal, for in malleable castings practice an iron with about 0.75 per cent silicon can give white cast iron when dipped from the hot surface of the bath, and gray iron when tapped out from the colder bottom. This, if the samples are taken just before the entire bath is hot enough for tapping out, and the test pieces are of large enough cross section.

Metal Should Be Cooled

Melting under conditions of extreme superheat, necessitates that the metal be held before pouring into the molds, until it cools to the desired pouring temperature. This, rather than pouring into the molds at once and allowing the sand body to absorb and dissipate the surplus heat. Not only would the sand surfaces suffer in such an event, but the added heat to be cared for by the sand would so retard the freezing of the iron that large crystals could grow from the nuclei finally formed during the cooling.

In ordinary foundry practice, when the molder thinks iron too hot to use, instead of holding it to cool often adds a piece of scrap or some of the gates or sprues. This saves him time. However, if the theory of crystal growth from graphite nuclei is correct, the molder, besides cooling his metal will add a goodly quantity of graphite nuclei from the cold gray iron scrap added which his now colder iron is not able to dissolve. The result will be that he has reduced the quality of his dearly won superheated iron to that of an ordinary melt. Therefore, it would seem bad practice

to add cold scrap to extremely hot iron whether in the molder's hand-ladle or in a crane ladle of iron intended for important large molds. Further, this also may apply to ladle additions of ferroalloys, unless assured by the microscope that no graphite nuclei are present in the alloy.

Obtain Wide Ranges

Variety in compositions found in pig irons is sufficient to enable the making of any ordinary foundry mixture. The silicon content, for instance, may be had from almost nothing up to 16 per cent in American pig irons. In Europe, however, the choice in high silicon pig irons is limited and ferrosilicon is cheap. Hence its use to a considerable extent in daily foundry work. In the case of manganese, the selection of pig irons is not great and ferromanganese frequently is used in the cupola to raise the percentage of manganese in the castings made. Uniformity can be obtained by careful charging and the use of large mixing ladles, or a forehearth. Excessive loss through oxidation may be brought to normal by encasing the ferroalloy in a matrix of cement, which protects it from oxidation in the descending charges of the cupola until the melting zone is reached. The use of ferroalloys in cupola melting has been made acceptable, and it is possible to obtain quite wide ranges of composition safely and with reasonable economy, particularly when compelled to use pig irons and scrap deficient in elements desired.

The foundryman, hearing of the wonderful strengths and other qualities in cast iron obtained as the result of the recent researches, naturally wishes to approach, if not actually duplicate them in his own establishment. He first looks up the compositions of these high test cast irons and finds them high in silicon, at the upper ordinary manganese limit, sulphur and phosphorus low but the total carbon quite low. Ordinarily, 2.80 per cent total carbon for cast iron is not obtained easily from the cupola. It just can be done in the air furnace, with the maximum percentage of soft steel scrap used—about 35 per cent. The open hearth and the electric furnace can handle the situation readily. Most foundrymen, have only the cupola to melt with, and when it is recalled that steel melted in the cupola absorbs about 2.75 per cent carbon from the fuel, to get the desired 2.80 per cent total carbon in the castings would mean a practically 100 per cent steel mixture. However, with the aid of the ferroalloys, there is no reason why every foundryman should not at least improve his work by using high steel scrap mixtures. With high steel percentages, it is necessary to have enough silicon and manganese available while melting. Under the high temperatures involved, there is a chance of oxidation from the carbon dioxide of the cupola gases, and without the deoxidizing action of the two elements in question, a sorry metal would come out over the spout.

High degrees of temperature desired for molten metal from the cupola involve a sacrifice in fuel, and perhaps the best example of actual operation is to be found in making large radiators. Molten iron required for this work must be snow-white to avoid heavy losses through cold-shuts in such a thin class of pressure castings. Melting has to be done with a moderate blast volume—say that giving about three-quarters of the normal hourly tonnage capacity. The fuel bed must be high enough to allow a time interval of ten to twelve minutes between putting on the blast and observing the molten metal running from the open tap-hole over the spout. With the best of coke the ratio of metal to fuel between charges should not be more than 8 to 1, and with high ash cokes which are rather friable, this may have to drop to 6 to 1. Metal charges must be small enough to hold the intermediate coke charges down to a layer about 4 inches thick, and charging must be done carefully to get level layers. If, after the cupola has been fully filled it can be allowed to stand for an hour or more, to warm up well, the first iron will be hot enough to use, and shortly after starting, the molten metal will come out extremely hot.

Gives Composition

Applying this theory to an all-steel charge, it is necessary to remember that steel in itself, when melted in the cupola, requires more fuel than cast iron—not only because of the higher melting point involved, but also the necessity of higher temperatures of superheat to keep the metal obtained sufficiently fluid for proper pouring. Even with the best coke—low ash, solid structure and free from small pieces—a charging ratio of not more than 7 to 1 will be necessary. Oftentimes 6 to 1 may prove desirable, and poor coke had better not be experimented with at all.

So far as the make-up of the mixture in all-steel melting is concerned, this is comparatively simple. The composition of the castings desired will be about the following: Silicon, 2.50 to 2.75 per cent; manganese, up to 1.00 per cent; sulphur as low as can be conveniently had; phosphorus, if possible as low as 0.10 per cent. Total carbon preferably as low as 2.80 per cent. As the steel in melting will pick up just about the desired total carbon, and the sulphur and phosphorus contained are each about 0.05 per cent, there will be no difficulty along these lines. Only the silicon and manganese will have to be arranged for, and here it is safest to consider that the usual 0.20 per cent silicon and 0.40 per cent manganese in steel are oxidized out in melting it under cupola blast conditions. Taking the 45 per cent ferrosilicon and the 80 per cent ferromanganese varieties, and allowing the usual melting loss of 10 and 15 per cent, respectively, the mixture would figure out about as follows: Low carbon, steel scrap in pieces between ¼ and 1-inch thick, 92.5 pounds; ferromanganese, in briquets, 1.5 pounds; ferrosilicon, also in briquets, 6.0 pounds for every 100 pounds of the mixture charged.

Preheat the Blast

Preheating of the blast will aid materially in the attainment of the desired extremely high temperatures in the molten metal. A desirable construction for this preheating of the cupola blast would seem to be the introduction of two regenerative chambers filled with checker-brick just above the open charging door, through which the burning gases are allowed alternately to pass up the stack. Sending the air from the blower through these two chambers alternately, as in the usual open-hearth furnace manner by valve reversal, and down through the cupola tuyeres will add about 750 degrees Fahr. to the blast temperature before it enters the fuel bed. That this will mean much fuel economy if the cupola is run rationally, also marked temperature increases in the melting zone, can be judged from the recent developments in preheating the blast from the waste cupola gases recuperatively.

Until the recent developments in high-test cast iron, the only apparent avenue of betterment of this material seemed to lie in the addition of such metals as nickel, chromium, vanadium, etc., or the production of what could be called alloy cast irons. These may be produced either by direct addition in the ladle or cupola, or as component elements of the irons charged. The quality of the castings were improved either for strength or wearing qualities. However, the amount and condition of the graphite in cast iron always will have the most powerful effect upon its physical qualities and giving this factor more weight when judging erratic alloy addition results, will ex-

(*Concluded on Page* 459)

Bill Touches on Some Problems in Molding-VI

By Pat Dwyer

WHEN I sat down to dash off this little effort—dash perhaps is a slight exaggeration, but let it stand—I was tempted to write: That fellow Bill will be the death of me some day. So far as my memory serves I never have used that statement, but like many other words and phrases that rise unbidden to tempt me, I have heard it so often that it floats into mind without any conscious effort.

My first active dislike to the phrase arose from its constant reiteration by the mother of a gallus young whelp who lived near me when I was a young lad. Even at that time, before I ever had any idea of attaining to the dignity of a position where I should be called upon to maintain discipline with children of my own, I felt like suggesting to her that a few vigorous applications of an axe handle would insure her a long and peaceful life. As a matter of fact, even without any friendly suggestion on my part she survived long enough to practice her favorite saying on her grand children. To give Bill due credit I don't suppose he ever will be the death of me, but certainly he is an aggravating creature. When we go any place together he never shows up until the last minute, thus keeping me grilling slowly over the agonizing fire of suspense. Leaving Philadelphia the other night he came tearing through the gate of the Pennsylvania station at Broad street and grabbed the hand rail on the last car just as the train began to gather headway. When I attempted to remonstrate over his criminally negligent and dangerous habit he looked me brazenly in the eye and remarked calmly: "Well, I made it, didn't I?" Later, over a quiet pipe we reviewed some of the features, events and incidents of the convention and Bill was reminded of a manuscipt he had received a few weeks ago from our mutual friend George Pickop while George was recuperating in Florida after a major operation. "Read it," said Bill, "its a knockout."

Dear Bill:

Shortly after I arrived here I was invited to spend a few days and nights at the bungalow of a friend. He laid the cards fairly on the table, face up, but I assured him I was willing to accept and share all conditions.

Before retiring he says: "George," he says, "what do you usually do to guard against the bites of bed bugs?"

In the proper spirit of camaraderie I says: "Nothing. I am willing to act the sport and take whatever fortune sends, bites included."

We prepared for the night's rest. My friend rubbed himself all over with some sort of a gooey preparation, put up some place in Cleveland and made up of various by-products of the Standard Oil Co.

You know, Bill, I have a reputation as an analyst of sorts. I slipped a small flash light into the pocket of my nightie and determined to make a study of these noctural prowlers at close range. As the night wore on I began to think either nothing was going to happen, or perhaps that as a result of a long and abstemious life on a strictly vegetable diet, I was immune. The night was hot enough to make me warm and restless and I was soon to find that natural restlessness can be augmented immeasurably by the activities of a husky and ferocious bed bug. Finally I flashed the light!

Several of the vanguard, husky young braves already were working on me. They were followed by the dense and unserried ranks of the regulars. The landwehr, women and children brought up the rear. Women, children and camp followers scattered and fled at the first flash, but the landwehr (veterans of 45 years and over) stood firm to await developments. Under the withering glare of the search light the entire force finally retreated in good order with baggage and ammunition.

The incident furnished an inspiration. If I could get 'em—and I mean get 'em good—before they scaled the bed I calculated I had a fighting chance. Later I returned to my own apartment to study the subject intensively and map out a campaign. I had promised my friend to develop a scheme for destroying the pests, thus conferring a real benefit on him and incidentally on all mankind. My inspiration was based to some extent on a memory of the story of the Pied Piper of Hamlin who piped all the rats out of his village. Now Bill, you know as well as I that while a rat with a musical ear might be induced to follow a piper, the delicate and elusive bed bug must be approached in a more subtle manner. An instrument breathing soft, dulcet tones of the purest melody is needed. Immediately the lute came to mind. The more I thought of the lute, the stronger I was sold on the idea. I decided to acquire a lute, to buy one if necessary, and then to practice diligently until I became sufficiently proficient to produce a melody, sweet and

FREES A JOLLY GOO' FELLA HIC, HIC, AN' HOW!

low that would lure the shy and discriminating bug from its curly nest in the rug. Before starting out to seek the instrument I decided to learn a little of its history, construction and other features. Up to that time, Bill, no kiddin', I never had seen a lute. Believe me, the investigation took me far afield.

Back in the Babylonian days of king Nebuchadnezzar's reign I found reference to the origin of the lute. It seems that old Neb. (I have not time to look up the spelling of that bird's name again) was fond of his moonshine and still more of music. He was particularly fond of his band of flutists. When in his cups (ancient Babylonian for pickled, pie-eyed, woozy) he was accustomed to shout in stentorian tones "Bring in my flutists and stay them not 'till dawn—Hic!" One night he entertained the local chamber of commerce at the palace. He sat in regal state on his throne and drank copiously to each speaker as introduced. He became more and more mellow as the evening wore along to the end of the speaking program. Then the king roared the good old roar for his flutists. His heavily impregnated breath got tangled up with the consonant *f* in the word flutists. His false teeth shot from his mouth like the wad from a kid's pop gun and were dashed to fragments on the gold, onyx, ebony and ivory floor of the throne room.

History is silent on the closing scenes of the party, but presumably old Neb. (contraction as before) set his artificers and ceramists to work on a new set next day. He also issued a royal decree that henceforth and forthwith throughout his kingdom the flute should be called a lute, thereby killing the objectionable and hazardous consonant *f*.

Construction of the instrument was somewhat changed at this time. Instead of standing straight out from the face of the performer as formerly, the mouthpiece was bent so that the instrument might lie in a perpendicular position adjacent to the chest. This greatly simplified manipulation and placed the instrument within the reach of those afflicted with short arms.

Cuniform inscriptions indicate that the art of luting at once became immensely popular with conductors on the cars of the surface, elevated and subway lines of the Babylon Light, Heat & Power Co. Many of them qualified for the royal orchestra where one of them composed the famous *Prisoner's Song*. That will suffice for the lute and its history.

When I fared forth in this balmy place to procure me a lute I found I might as well look for a double breasted red flannel under shirt. After a fruitless search through all the principal music stores I at length located one in a toy shop kept by an old German. He remembered that he had given it to his daughter and that all her children had cut their teeth on it. It was filled with ginger cookie crumbs and—er—what not, but it was a lute. I decided it could be cleaned sufficiently to give forth the luring sounds it was designed originally to render. I purchased it.

In the quiet and peace of the kitchen with the door locked I boiled it in a 10 per cent solution of lye water and then reamed the thing out so that finally it was restored to what you might call a lutable lute. Then followed the rehearsals and the laying of the plans for the slaughter and general cleanup.

A reliable type of vacuum cleaner

A PRANCIN' GOAT! SPRING IS HERE!

(name given on request) was procured for the final mopping up. My friend practiced diligently to acquire the necessary speed, skill and proficiency in its operation, while I proceeded to do likewise on the persuader. At the expiration of a few hours I found that luting was duck soup to me. Long familiarity with pneumatic equipment smoothed the path.

With a truly masterly rendition of the triumphal march from *Aida* I already had lured a dozen or more beach bugs and land crabs through a 4-inch concrete wall of the apartment when the landlord called on me.

"If you want to pay the rent on three adjoining empty apartments," says he nastily, "just keep on wailing on that small sized edition of a saxaphone. If not," says he, "take it down to the beach and drown it—and yourself." A regular sour guy, he was.

I at once saw that he as well as the neighbors lacked musical appreciation. I told him so with divers and sundry other things that may be deleted. Sound stuff, you understand, Bill, but most of it I am afraid went over his head, wasted, you might say since he never had been blessed with a foundry training.

Well, Bill, the story now is approaching the denouement, the grand climax. Next day I proceeded to my friend's bungalow and in the afternoon practiced on cockroaches with gratifying success. I tried the *Lohengrin Wedding March* on them and we collected 8 quarts—8, count 'em—and a pint of the finest specimens.

That night the problem of practical bedbugging on a scientific basis was solved definitely and forever. I decided to lie on a blanket on the floor so that the bed might be removed to facilitate the operation of the vacuum cleaner. The interior of the bag was smeared lightly with insect powder and a good reliable liquid core binder. My position on the blanket was patterned carefully after that of an arcadian shepherd lying on his skin mantle on the hill side the while he tootled sweetly to his gentle flock.

All lights were extinguished and I started softly with the overture from *William Tell*. If I do say so myself Bill, it was good. The friend's family felt immensely flattered. I says to myself, "To h—l with the bugs and other varmints. If they want to stroll in careless like during the concert, it will be O. K. with me." The moon came up and shed its mellow rays through the window, making a wide well lighted path across the floor where I could watch the invaders and note their response to my concert. The *Barcarolle* from *Tales of Hoffman* evoked a warm response from the family, but little did I anticipate the effect on the bugs. They came down the walls literally in thousands, in companies, in squadrons and platoons, eyes right, forward march and congregated in the patch of moonlight. They came from the base boards and floors and joined gayly and with the utmost abandon in the grand assembly.

It was their last fling! The final kick! The old guard at Waterloo! The deadly vacuum cleaner deftly guided by a master hand gathered them into its naw, body and bones, hoofs, hides, hair and tails.

The lute had won.

Musically yours,
George.

"That shows you," said Bill, "what an ingenious lad can do on almost any job when he sets his mind to it. Consider the different methods of handling the various phases of molding the trough I have mentioned previously. In the second of three alternative methods, the foundryman decides to form the outside of the mold in a flask or in the floor and lift the core out so that he may finish the walls properly and if necessary, skin dry them.

In the first method described previously, the core is left intact on the bottom while the outside of the mold is made in such a manner that it may be lifted away in a cheek with lifting plate or chuck bars and finished. Several styles of lifting plates are available for the purpose.

"One of the factors to be considered here, one that does not apply where the core is not removed from the mold, is the necessity for providing some means for anchoring the core after it is returned to place so that it will

not shift or float after the mold is filled with iron. Under exceptional circumstances where the mold is poured entirely from the top and where it is certain that the iron in the bottom of the mold will freeze and thus form a seal before the iron in the walls has risen to a sufficient height to exert a pressure equal to or in excess of the weight of the core, this precaution may not be necessary, but it is a dangerous risk. In the interest of safety the core should be anchored. Two methods are available. In one the core is anchored to the bottom. In the other it is held down by chaplets on the top. The second method is the simpler of the two, but unfortunately the customer sometimes objects to the presence of chaplets. Of course, instances are known where castings leak in the vicinity of chaplets, but where proper precautions are observed this will not happen. Also in the particular casting under discussion, a minor leak is of little consequence. The pressure in a water trough is not severe and besides the tiny passage will rust in a short time and become water tight. However, as I said before if proper precautions are observed, that is if perfectly clean chaplets, preferably tinned, are employed, the casting will not leak at these points.

"After the sand has been rammed to the top of the pattern on the outside a suitable sweep with a shoulder resting on top of the pattern is employed to form a seat on the bottom of the inside for the lifting plate. The depth of this seat is regulated to bring the upper face of the plate flush with the bottom edge of the pattern or slightly below it. To avoid any danger incident to contraction of the casing, the lifting plate is made from 2 to 4 inches less in width and length than the pattern. This gives a clearance of from 1 to 3 inches at the sides and ends.

"The lifting plate is provided with a steel staple near each of the four corners for attaching the crane chains. These loops extend to within an inch or two of the top of the core. The plate also is pierced with several generous openings through which the gas may escape to the cinder bed below. On the lower side the plate carries three cone shaped projections designed to guide it accurately into place. When the plate is lowered the first time these cones sink into the sand and form hard packed seats. After the core has been lifted out, finished and lowered once more the cones will enter the same seats and insure a uniform thickness in the casting. Dependence cannot be placed altogether on the tapered edges of the plate. Three cones, two near one end and one near the other are used in preference to four to prevent any possibility of replacing the core *end for end.*

"After the plate has been rapped down firmly on its sand bed, the clearance space all around is packed full of sand and a parting is slicked from the edge of the plate to the lower edge of the pattern. This method of making a parting insures a snug fit and is preferable to making a parting by guess before plate is lower. Also it is faster.

SPORTING TERM—CALLING THE GAME

"Parting sand or paper is sprinkled or laid on the narrow strip of sand. Facing sand to a depth of ½-inch is distributed over the paper and extending back from the pattern to a distance of 6 or 8 inches. Six-inch spikes or small steel rods of a similar size are laid in this sand about 2 inches apart with the points almost touching the pattern. These rods reinforce the overhanging sand and insure a clean *lift* a minimum amount of patching and a close fit when the core is replaced.

"Detail of ramming the core has been described previously. However, in this instance four standards will be required for chaplet piers. Wood blocks are the most convenient since they may be cut readily to the proper length, a length that will bring the upper end within approximately 4 inches of the top of the core. The remainder of the distance is made up with a brick or suitable pieces of iron. A couple of 2-inch stud chaplets, one on top of the other will serve. An ordinary stem chaplet may be placed on the block with sand snugly tucked around the stem up to the face of the core.

"This last method is the most workmanlike since a small button may be formed in the sand around the stem, thus insuring a tight grip. After the casting is cleaned the stem is cut off inside and outside the casting and if necessary the stumps may be riveted. The only objection to the method is that unless they are fastened down perfectly plumb they may slip and thus become useless. However, if the stem is gripped between two bars or led up through a small hole in a suitable binder bar, the danger is neglible. The lower end of the block rests sodily on the lifting plate and the same practice is observed if a short piece of rail or other form of iron standard is employed. In many shops cast iron stools of various lengths are available. The particular shape and material of the standard is immaterial so long as it rests solidly on the plate and is erected perfectly plumb. That is one of the features which cannot be neglected.

Gives Equipment Orders

The index of gross orders for foundry equipment in April was 107.7 as compared with 138.6 in March, according to a report of the Foundry Equipment Manufacturers association. The index of shipments was 112.5 in April as compared with 147.9 in March. Unfilled orders dropped slightly from 127.1 in March to 126.1 in April. The average index of gross orders for the first three months of 1928 was 131.6. The base is the average monthly shipments for the years 1922-23-24. Comparisons of monthly orders follow:

	1924	1925	1926	1927	1928
Jan.	141.8	104.2	168.2	180.4	132.7
Feb.	121.0	108.8	154.9	198.0	123.6
March	121.9	159.3	157.3	131.1	138.6
April	146.8	124.3	113.2	130.0	107.7
May	108.0	113.3	128.5	134.8	.....
June	96.4	110.5	133.5	138.4	.....
July	62.8	117.0	127.3	89.9	.....
Aug.	77.5	190.0	141.2	106.4	.....
Sept.	66.0	94.2	114.0	80.4	.....
Oct.	85.5	149.5	140.5	98.0	.....
Nov.	91.4	180.3	133.4	95.8	.....
Dec.	137.8	140.1	181.0	106.8	.....

The FOUNDRY Family Photograph Album

Upper Left

E. J. BYERLEIN
Milwaukee Foundry Equipment Co., Milwaukee

Lower Left

WILLIAM H. WOODIN
American Car & Foundry Co., New York

Upper Right

W. M. CORSE
Washington

Lower Right

J. W. OLIVER
Standard Sanitary Mfg. Co., Pittsburgh

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

A LEXICON OF TECHNICAL TERMS

By O. W. Potter

(Continued from Data Sheet No. 718)

Specific Resistance (Resistivity)

The electrical resistance of a specimen with one square centimeter cross section and one centimeter long. It often is compared to the resistance of mercury (Hg) the same cross section and volume as unit resistance (ohm). Examples:

	Microhms* per cubic centimeters at 0 degrees Cent.
Pure iron	9.0
Mild steel	10.0-15.0
Wrought iron	13.8
Malleable iron	32.5
Gray cast iron	74.0-105.6
White cast iron	57.0-74.0
Hard steel	45.0
Cast steel	19.0
4 per cent silicon steel	51.15

*A microhm is one one-thousandth of an ohm.

The elements, tungsten, cobalt, nickel, copper, carbon, manganese, silicon and aluminum, increase the resistivity of the alloy in the order named; tungsten the least and aluminum the most.

Temperature Coefficient of Resistivity

The fractional change in conductivity per degree change of temperature.

Magnetic Properties

The property of exciting an attractive or repulsive force of measurable magnitude on another substance.

A material which has this property is said to be *magnetic, paramagnetic,* or *ferromagnetic.* Iron is strongly magnetic and cobalt and nickel are weakly magnetic. Materials which do not have this property are said to be *nonmagnetic.*

Soft steel=Temporary magnet.
Cast gray iron=Temporary magnet.
White cast iron=Permanent magnet.
Hard steel=Permanent magnet.

(Continued on Data Sheet No. 720)

A LEXICON OF TECHNICAL TERMS

(Continued from Data Sheet No. 719)

Maximum Permeability

The maximum ratio of flux density, *B*, set up in a material to the magnetizing force, *H*.

Examples: (Slight changes in treatment will greatly affect these values.)

Swedish charcoal iron	4,870
Transformer steel	3,850
4 per cent silicon steel	3,400
Swedish iron melted in vacuo	10,350
Electrolytic iron melted in vacuo	12,950
Cast steel	3,550
Cast steel (annealed)	14,800
Cast gray iron	240
Cast gray iron (annealed)	600

Coercive Force

This is the negative value of magnetic force in Gilberts (centimeter-gram-seconds) required to reduce the induction in the substance to zero (if induction has been reduced to zero from point on normal induction curve the coercive force is called the normal coercive force). A Gilbert is one line of force per square centimeter and is the unit of field strength, *H*.

Examples:

Wrought iron	2.30 Gilberts
Malleable iron	8.80 Gilberts
Gray cast iron	3.80 Gilberts
White cast iron	12.24 Gilberts
Mild steel	1.6-1.9 Gilberts
Alloy steel	7.0-51.0 Gilberts

Demagnetizing Force

Demagnetizing force is the reversed magnetic force which is usually in Gilberts and is the coercive force of the substance.

Examples:

Gray cast iron	17.03 Gilberts
Wrought cast iron	20.40 Gilberts
Alloy steel	12.0-70.0 Gilberts
	(Soft) (Hard)

(Continued on Data Sheet No. 723)

Milwaukee Plant Heat Treats *Miscellaneous Steel Castings*

One-third of Foundry's Output Is Quenched and Tempered in Electrically Heated Furnaces Having Novel Charging Devices

By A. W. Lorenz

ABSTRACTED from paper presented at annual convention of American Foundrymen's association, Philadelphia, May 14-18, 1928. The author is metallurgist, Bucyrus-Erie Co., South Milwaukee, Wis.

EXPERIENCE of the Bucyrus-Erie Co. with heat treated steel castings extends over a period of 18 years. At present approximately one-third of the entire output is quenched and tempered as differentiated from the ordinary annealing process to which all castings are subjected before they leave the foundry. To handle the special work properly, plans were prepared in 1926 for a new building which should represent the most modern development in efficiency of operation and ability to produce high grade steel. The first unit of this new department with a monthly capacity of 500 tons was completed in September, 1927. Eventually the building will be expanded and equipped to handle from 1000 to 1500 tons of steel castings per month. Several distinctly novel features have been introduced in the method for handling the castings in the process of manufacture.

The building 65 x 80 feet, of brick and steel sash construction with concrete floor, extremely well lighted and ventilated, offers sharp contrast to the old idea that heat-treating shops should be clothed in darkness.

A good broom constitutes part of the regular equipment, and the floor is cleaned at regular intervals. The cleanliness of the shop, even in periods of maximum production, has attracted comment from all who enter the plant. These conditions stimulate and encourage careful workmanship.

Adjacent to the main building is a side bay, 35 feet wide, in which the substation is housed. This substation furnishes power also to an electric melting furnace in the steel foundry, and for general purposes.

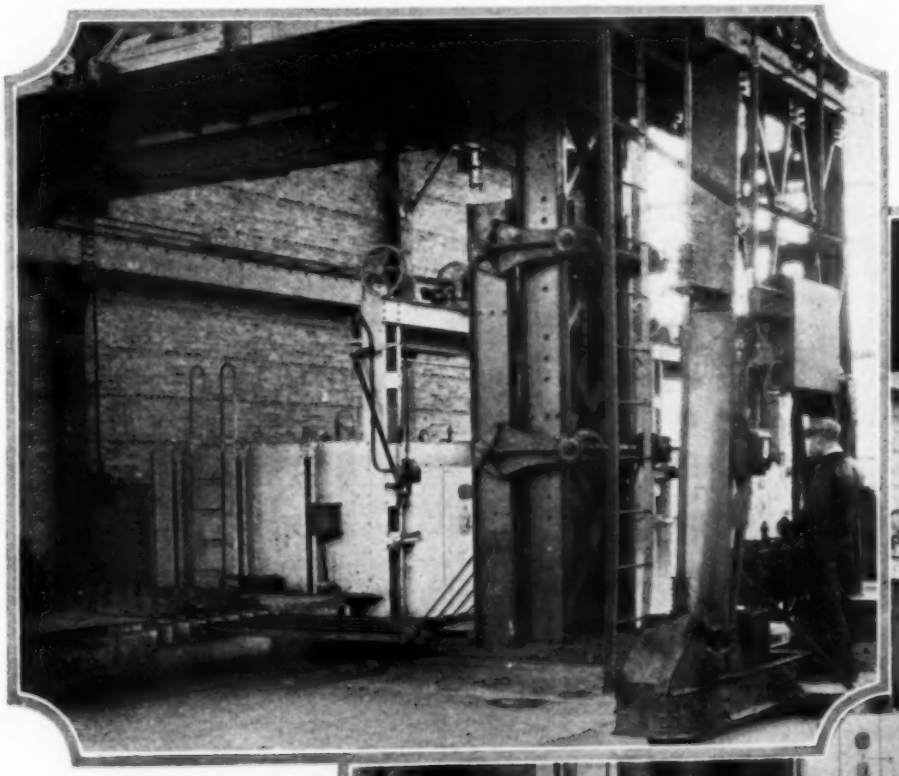
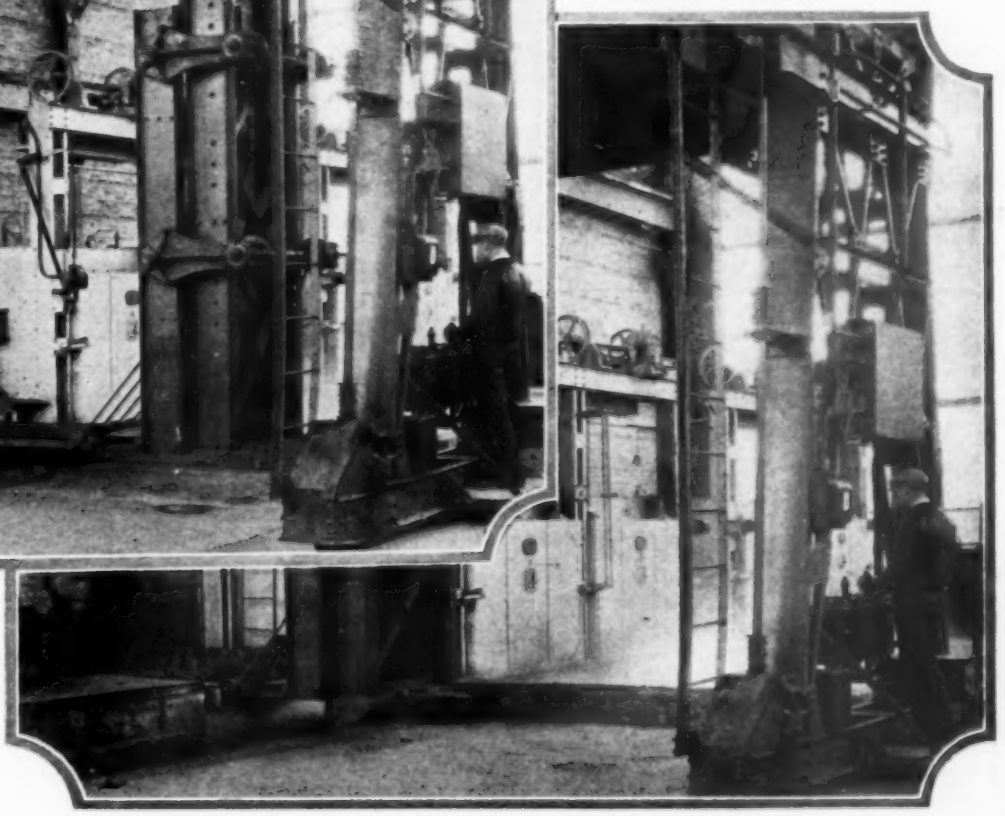


Fig. 1 (Above)—The Loading Rack Is Shoved Into Place in Front of the Charging Machine which Is Controlled by the Man Shown at the Right

Fig. 2 (Below)—A Series of Structural Steel Members Slide Fork Like Under the Castings and Elevate Them for Transfer Into the Annealing Oven



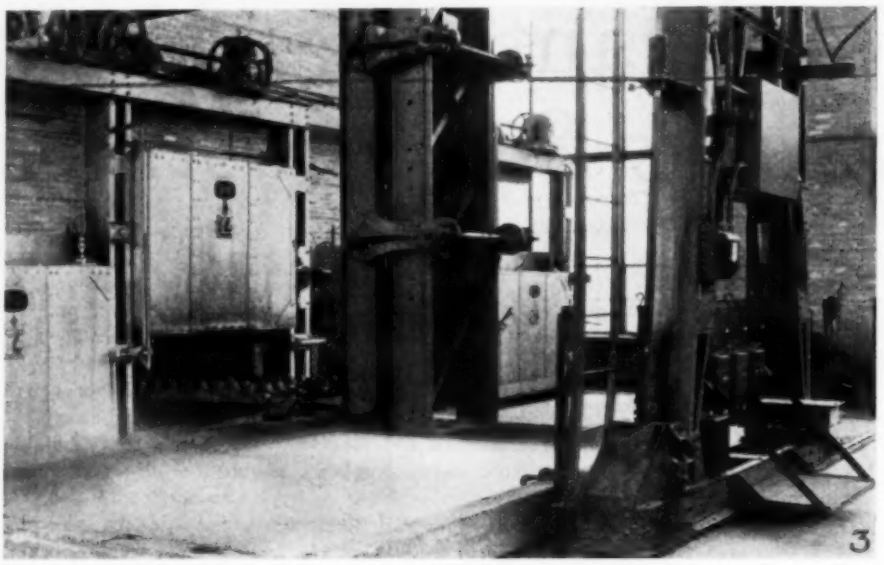


Fig. 3

HERE the charge is on the prongs of the specially-designed charging machine and is being pushed into the quenching furnace shown at the left, where it will rest on rails.

Directly in line with the heat-treating department, and 160 feet distant, is a building at present used for foundry purposes, 120 feet long. Design and construction of these two buildings are identical, so that with the intervening space already noted, provision is made for practically unlimited expansion.

The heating equipment is unusually simple, consisting of four box-type electric furnaces with hearths 5 x 6½ feet, and one single-chamber car-type electric furnace, with car 3 x 14 feet. With a large-scale production in mind, first leaning naturally was toward some type of automatic or semiautomatic continuous furnace, but while such furnaces may be of advantage on selected or special work, none could be found which would handle all types and sizes with equal facility. With castings ranging from 5 to 2000 pounds in weight, the difficulty of automatic or continuous operation will be appreciated. Decision finally narrowed down to simple box and car-type furnaces, because of their flexibility.

While the choice of electricity was largely dictated by an extremely low power rate in the Milwaukee district, it should also be noted that this type of heat presents several distinct advantages which peculiarly adapt it to heat-treating operations:

(1) Extreme uniformity of heat application.

(2) Extreme closeness of temperature control.

(3) Impossibility of unduly forcing a heat.

All these factors are important in securing a uniformly high-grade product. Regulation, of course, is entirely automatic, by a well known type of pyrometer-controller sensitive to 5 degrees plus or minus. The box furnaces are of the twin-chamber type. Heating elements are nichrome ribbon, located under the hearth and on the roof. The hearth itself is formed of alloy castings, in the shape of an inverted T, providing not merely a hearth, but also a series of rails, 8 inches high on 8-inch centers.

The car-type furnace is of conventional design, with heating elements on the side walls only. Bottom heat was considered unnecessary on this narrow furnace.

The shop is served by one 5-ton traveling crane, one gasoline driven tractor, and one charging machine of special design. Method of charging the box furnaces by this charging machine constitutes the most unique feature of the installation.

Figs. 1 to 6, show that the machine is essentially a one-leg gantry or traveling crane, equipped with a set of six horizontal prongs suspended from an overhead trolley in such a manner that the prongs may be moved up or down, in or out, at the will of the operator. The whole machine travels up and down the shop on suitable rails set in the floor and

Fig. 4

AFTER the charge has been heated in the quenching furnace, it is removed on the forks of the charging machine. Here it is shown as it leaves the furnace chamber, preparatory to being plunged into the quenching bath.

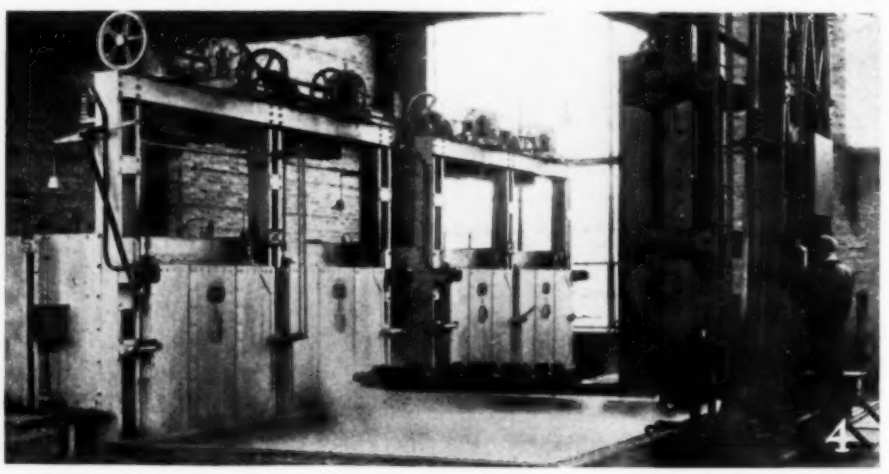
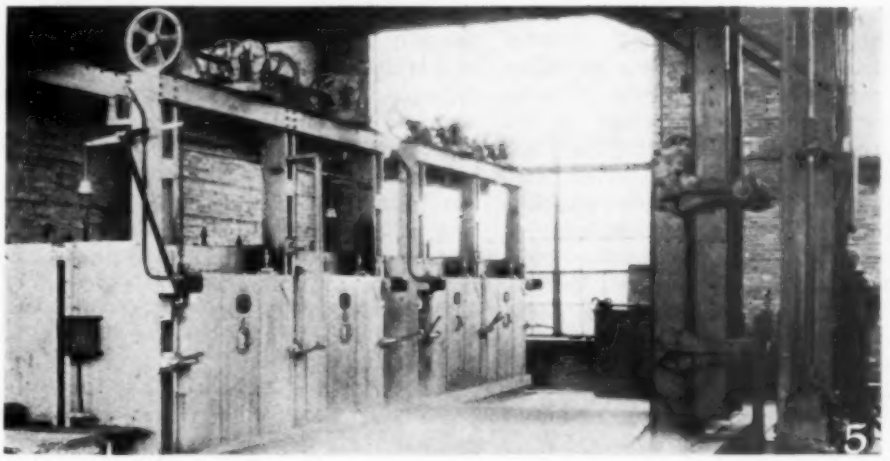


Fig. 5

THE forks are lowered, submerging the charge in the quenching tank. The advantage of having the tank immediately in front of the furnace is evident from the fact the transfer of charge from furnace to tank consumes from 5 to 10 seconds.



on the brick side wall of the building.

An elevated platform extends along the side of the building, in alignment with the four box furnaces. This platform is used for loading and discharging materials in and out of the furnaces. The platform is 20 inches high, permitting material to be unloaded from trucks or trays with a minimum of effort.

Set in this platform are two loading racks, exact counterparts of the furnace hearths, a set of rails, 8 inches high, spaced on 8-inch centers. The top of each rack is flush with the surface of the platform.

A quenching tank, 5x12x17 feet, with a working capacity of 6500 gallons sits immediately in front of the quenching furnaces. This tank is filled with water, maintained at a temperature of 125 to 150 degrees Fahr. through steam and cold water inlets. It is also connected through a circulating system with a cooling tower on the outside of the building.

Material is delivered by truck or by crane to the loading platform, where two helpers arrange the pieces upon one of the loading racks. Pieces over 16 inches in widest dimension, and some pieces as small as 8 inches, rest on the rails without further support. Smaller castings are placed upon perforated trays. The fork of the charging machine then is moved forward and inserted between the rails of the loading rack, beneath the charge.

The entire carriage then is raised, thereby lifting the whole charge off the loading rack. The charge is transferred to one of the quenching furnaces, where by a reversal of the previous operations, it is deposited on the furnace rails. The charges usually range from 1000 to 4000 pounds in weight, and the transfer is effected in from 30 seconds to one minute. Quenching is performed in like manner, but since the quenching tank is directly in front of the furnaces, the heated charge is transferred from the furnace to the tank in from 5 to 10 seconds. After the quench, the charge (still supported on the charging fork) is transferred to a second furnace for tempering.

The entire cycle, including the opening of the doors, is handled by one man on the platform of the charging machine. The furnace doors are controlled by push buttons set on posts within convenient reach of the charging machine operator. Limiting devices, stops, and indicators, permit perfect alignment of forks before opening the doors, protecting the furnaces from damage, and speeding up the transfer with minimum loss of heat.

Notwithstanding the economy of this arrangement, it has been obtained without the least sacrifice in quality of the product. In fact, the method has several advantages. Pieces never are piled promiscuously, but are neatly and uniformly placed, always in the same position. The quenching is not a mere dumping proposition. Each piece is fully exposed on all sides to the quenching medium. The whole scheme promotes a uniformity in heating and quenching seldom ob-

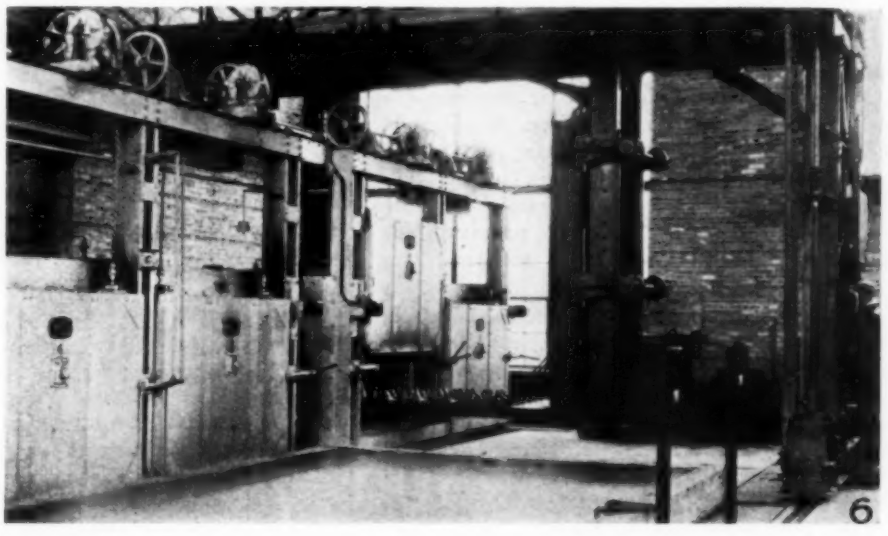


Fig. 6

AFTER the work is removed from the quenching bath it is charged into one of the draw furnaces. The contral stations fo.' operating the furnace doors are shown in the right foreground. The tempering operation adds much to the properties of the castings.

tained in heavy pieces, except with automatic quenching devices.

With the general trend of steel foundries, so far as electric annealers are concerned, toward twin or even three-chamber types, it may be interesting to observe that in the present installation, the car-bottom furnace consists of only one chamber and one car. Such an installation is not adapted for furnace-cooling treatments. It is intended entirely for the heating of special air-hardening steels, also for shafts and similar pieces for quenching.

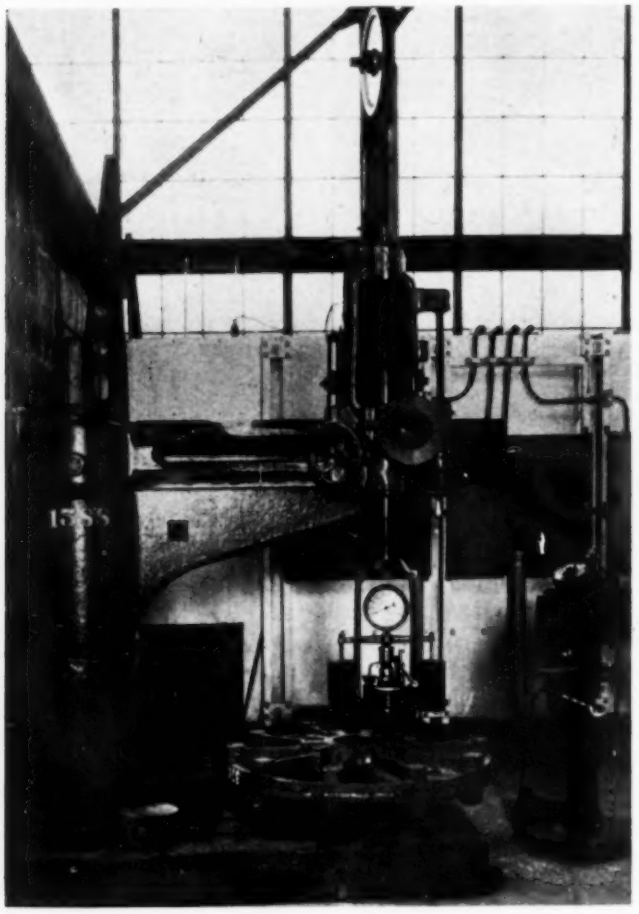


Fig. 7

IN ORDER to facilitate the testing of heavy castings for hardness, a brinell head was mounted on the arm of an old radial drilling machine.

It is well established that furnace or slow cooling is decidely inferior to air-cooling for development of maximum strength, and it was not considered the function of this plan to equip for such a treatment. Nevertheless, the method of operating this furnace tends to produce normalized or quenched and tempered castings at a cost not appreciably greater than that of simple annealing in twin chamber car-type furnaces.

For handling work on cars, a carefully balanced lifter is used which again employs the prong idea, and is suspended from the overhead traveling crane. A rack made up of 12-inch *I*-beams also may be observed, supporting a suitable furnace charge. The beams are placed on 18-inch centers, similar to the spacing of rails on the furnace car. With this apparently unwieldy, but really quite simple device, a car may be unloaded, reloaded, and shoved back in the furnace, in 5 minutes, thus increasing efficiency not merely by continuous utilization of the heating chamber, but also by reclaiming a large portion of the heat stored up within the car itself. With twin car types, nearly all the heat absorbed by the car is lost. Naturally, also a saving is effected in maintenance and depreciation costs with the simpler equipment.

Removal of the heated parts to a separate rack for cooling is distinctly beneficial where air-cooling is desired, since the cooling rate is considerably more rapid and uniform than could be obtained on a hot car. The racks entirely open underneath, permit free access of air. Maximum hardening conditions are further promoted by light loads, carefully arranged for rapid cooling.

The lifting device described also is used in quenching operations, showing up to good advantage in the quenching of heavy shafts. Common procedure is to hook one or more chains around the shaft, or around bars supporting the shaft as it rests on a hot car, quite an uncomfortable job for the workmen, and not always performed with facility. With the lifter, the workmen always are stationed at a comfortable distance from the car, no adjustments are needed, and the whole charge may be picked up at one time and transferred to the quenching tank without delay.

Entire routine incidental to this plant for a monthly output of 500 tons is handled by three men on day turn, and two men on night turn. One of the day crew devotes 25 per cent of his time to brinell inspection and takes care of the clerical duties.

Checking of brinell hardness on treated work is a routine procedure, and to facilitate the testing of heavy pieces, the brinell head has been mounted on the arm of an old radial drill machine. Castings are placed on the drill table, and the brinell apparatus swung into position above the point to be tested.

Win Cartoons from the Daily Foundry

Four cartoons burlesquing various convention activities were featured in the consecutive issues of the *Philadelphia Convention Daily* of THE FOUNDRY. Visitors to the Penton Publishing Co. booths at the exhibition hall were asked to register and on the closing day Miss J. Reininga, assistant to C. E. Hoyt, secretary-manager of the A. F. A., drew the names of the four winners to whom the original famed drawings of these cartoons were presented. The cartoons are the work of Harry L. Richey, creator of the characters shown in each issue with the "Bill" stories by Pat Dwyer. The four originals were won by Mrs. J. D. Wise, Cleveland; E. R. Wolverton, Bloomsbury, N. J.; L. W. Kreicker, Chicago, and Clifford B. Cornell, Cleveland.

Receives Appointment

E. D. Hallock, has been appointed advertising manager of the Alexander Milburn Co., Baltimore. For a number of years he was advertising manager for Gray & Dudley Hardware Co., Nashville, Tenn., and later prepared advertising for a number of companies including the Solvay Process Co. He also was associated with a New York advertising agency and with the Green & Van Sant Co., Baltimore.

Griffin Wheel Co., Chicago, has leased space for its executive headquarters in the New York Central building, now under construction on Park avenue between Forty-fifth and Forty-sixth streets, New York.

How and Why in Brass Founding

By Charles Vickers

Contains Defects

We are sending for your inspection a gated casting so you will understand the difficulty we are trying to contend with. The casting is a sample of builders' hardware and you will note there are defects near the gate in the form of spongy holes that resemble slag. Also please note the small cracks which cause many rejects. We generally use an ingot supposed to be made of pure clippings of a 70-30 mixture. We also have tried mixing new metals but with no improvement, except that with a mixture of 76, copper; 19, zinc; 4, tin; 1, lead, plus 2 ounces of aluminum we eliminated the cracks, but the lead showed as blue streaks after finishing. The castings will not run minus the aluminum. We have tried many kinds of flux, without finding a way out of the difficulty. We have tried borax and rock salt also and a phosphorized alloy omitting the aluminum, but the castings failed to run and looked bad. We have tried various methods of gating but nothing seems to make any difference. The sample casting sent you is made of 70 per cent copper; 30 per cent zinc; plus 2 ounces of aluminum per hundred pounds of alloy.

All this trouble is caused by the addition of the 2 ounces of aluminum. While the aluminum eliminates some inconvenience in the way of smoke, it brings troubles all its own. The best remedy would be to introduce an old-fashioned yellow brass molder into the plant, then aluminum would be *skidded*, and all would be well. Since aluminum is favored, why not get its full benefit? The zinc could be increased to around 38 or 40 per cent, with 2 or 3 per cent of lead; copper, remainder, which would be a cheaper mixture and one that would run much better when aluminized than the low zinc mixtures now being used. However, the method of gating will have to be changed, but as it is not possible for us to give our ideas on this matter without making time-consuming drawings and diagrams, we will leave the matter with the molder, calling his attention to the fact that aluminized brass flows like soapy water. It will lather in the mold when two streams impinge, or the stream strikes against a wall of core and rebounds. The metal must be introduced into the mold without the least agitation, for all the defects our attention has been called to are due to this *lathering* effect. The alternative is to use a mixture consisting of around 70 per cent copper; 25 per cent zinc; 3 per cent lead and 2 per cent tin; *no aluminum*. The alloy, however, must be poured with decision, the flask being filled at one dip of the pot and it is best to use side tongs with a pouring bar.

Wants To Know Analysis

We are making brass castings that are used in dental laboratories in making rubber plates for false teeth. The castings form a three-parted flask in which the plaster cast is set up and placed in a boiling solution of sulphur water for about 2 hours during which operation the flask is forced together until it has to withstand a pressure of about 800 pounds. The castings we make prove too soft, they bend in the center and thus fail. We are sending you a sample from a flask that does stand up and so lasts longer than the ones we have supplied. This sample was taken from a flask imported from Germany. We would also like to obtain the formula for a pattern metal that is easy to file and can be soldered.

The cause of many manufacturing difficulties is to be found in that one little specification immediately following the request for a pattern metal formula, *easy to file*. Everything must be *easy* to do, also cheapness is the most important thing to keep in mind. In regard to the flask castings we are unable to even guess if the alloy that has been used was likely to be near what is necessary for such work because nothing is mentioned about the composition of the same. As far as the sample is concerned, it is always easy to learn the composition of such an alloy. All that is required is a chemical analysis, and with the sample at hand this becomes one of those easy things. Simply send it to an analytical chemist and he will inform as to its composition and from his report the same alloy can be given the customer as the Germans gave them. We will guess at the composition of the sample sent. The file reports that it is merely the well known copper, 88 per cent; tin, 10 per cent and zinc, 2 per cent, which alloy we should imagine would be just about correct for such work. A pattern alloy that will cast easy, file easy, but is not so cheap, consists of lead, 46 per cent; tin, 40 per cent; antimony, 14 per cent.

Formula Gives Changes

Kindly let us know if you have a simple form for changing one mixture of metal into another, say 88, copper; 10, tin and 2, lead, to make 85, copper, 5, lead, 5, zinc, and 5, tin, by the addition of new metals.

A simple method of converting one alloy into another is that described by W. W. Rogers in a paper presented before the American Institute of Metals, and which may be found in Vol. VIII *Transactions*, American Institute of Metals, pages 113-117. To convert 88-10-2, the author suggests the following procedure. Place the scrap it is desired to convert on the left and the alloy required on the right, thus:

88-10-2		Alloy Required	
Metal	%	Metal	%
Copper	88	Copper	85
Tin	10	Tin	5
Lead	2	Lead	5
Zinc	none	Zinc	5

Select in the left column the constituent that has the greatest excess over any similar one on the right. In this case it is the tin, 10 per cent in one case and 5 per cent in the other. Now multiply the 5 by 100 and divide by 10.

$$\text{Thus:} \quad \frac{5 \times 100}{10} = 50$$

This figure is the amount of scrap to be used in 100 pounds of the required alloy to add the amount of tin necessary. To get the copper calculate the amount of copper in 50 pounds of the scrap. This is 44 pounds. Deduct this from the copper contained in the alloy wanted, which leaves 41 pounds; the amount of copper to add to the 50 pounds of scrap. The required lead is arrived at in the same manner; one pound of lead will be carried by 50 pounds of scrap, so 4 pounds of lead are wanted. The zinc has to be added to the amount of 5 pounds. The final mixture then is: 50 pounds of scrap; 41 pounds of copper, 4 pounds of lead, and 5 pounds of zinc.

Studied Malleable Secrets
During the Seventies

Pioneer in This Industry Recalls Early Experiments Which Resulted in Establishing a Definite Ratio Between the Elements and Particularly Between the Manganese and Sulphur

By Alfred E. Hammer

ALTHOUGH my activities with the company with which I have been associated for so many years cover a wide range, readers probably will be more interested in the early history of the black heart malleable iron castings industry than in any other branch of the foundry business with which I have been associated.

Shortly after finishing the preparatory course for the Sheffield scientific school, Yale university, New Haven, Conn., I entered a laboratory specializing in metallurgical and chemical engineering under the direction of Professor Ernst Sjostedt who had studied under Professor Eggerts in Upsale University, Upsale, Sweden. At that time Professor Eggerts was introducing short and practical methods of chemical analysis of iron and steel.

Next I became connected with the Malleable Iron Fittings Co., Branford, Conn., under my father Thorvald F. Hammer who was an official and one of the organizers of the company in 1864. Here I learned the business from the bottom to the top. In 1875 the company established a chemical and metallurgical laboratory which, so far as my knowledge extends, was the first laboratory directly connected with the malleable foundry industry. Only a few malleable foundries were in existence at that time and these few were dependent absolutely on two or three charcoal blast furnaces for pig iron. Quite a number of furnaces were making pig iron, but in the state of the industry at that time only a few could be depended upon to produce a pig iron that could be converted into American black heart malleable castings.

Why these special irons should produce a black heart casting, while other irons would not, was one of the mysteries of the period which I set out to solve. When I looked about for information on the subject, I found myself practically a stranger in a strange land. I could find no textbooks on the subject and I could find no contemporaries who knew any more than myself. I found a few scientific papers that had been presented before societies in England, France and Germany, but they contained nothing that would assist me in solving the problem.

Original work was required and this work became positively exciting as I delved deeper and deeper. I had a mattress installed in the laboratory and with the help of an alarm clock I was able to follow the long and tedious chemical operations through the night without the loss of much sleep.

After working a year on the problem I discovered that the production of black heart malleable depended on a certain equilibrium between the carbon, silicon and manganese. Percentage of phosphorus in charcoal irons rarely exceeded 0.20 per cent, therefore it was not necessary to consider this element. For some time the varying sulphur content interfered with correct conclusions, but eventually I was able to lay down a definite chemical ratio between the carbon, silicon, manganese and sulphur, which under ordinary conditions would produce black heart malleable iron in the cupola or air furnace.

Later I reached a more definite conclusion on the ratio between manganese and sulphur. My old records show that in the proper analysis the manganese content is equal to twice the sulphur content plus 10 points. Thus if the sulphur is 0.10 per cent the manganese will be 0.30 per cent. An increase or decrease of 5 points in the manganese content does not affect the equilibrium.

In 1872 the French chemist Reamur almost hit upon this formula, but did not quite succeed even with the so-called white heart malleable castings.

In 1881 the great French chemist Forquignon published the results of his research on malleable iron, both in melting and annealing in *Annels de Chemie et de Physique*, but even at this comparatively late date he failed to establish a formula that would produce black heart malleable castings.

Cabinet Cyclopedia, Vol. 1, published in 1831 contains an article entitled *Lucas Patent Run Steel.* This patent was taken out by Samuel Lucas, Sheffield, England in 1804

Gives Historical and Technical Data

OVER 50 years ago the Malleable Iron Fittings Co. Branford, Conn., with which the present president Alfred E. Hammer then was connected as metallurgist, established a laboratory where research work could be carried on. So far as existing records show this was the first laboratory established in connection with a malleable iron plant. Mr. Hammer was one of the first on this side of the Atlantic to reduce the manufacture of black heart malleable iron to a scientific basis. His intense research extended over a considerable period, but he finally succeeded in establishing a definite ratio between the various elements which enabled him to utilize comparatively low cost coke and anthracite pig iron, previously considered unsuitable.

Mr. Hammer kindly furnished this information in response to a request for biographical data from those who attended the first convention of the American Foundrymen's association convention in Philadelphia. Through lack of space the material had to be considerably abridged in its presentation in the daily edition of THE FOUNDRY, *published in Philadelphia during the four days of the recent convention and exhibition. On account of its value and historical interest it is now presented substantially in full.*

for "a method of separating the impurities from proved or cast steel without fusing or melting it, and to render it malleable and proper for several purposes." Of course this patent had to do with the English and Continental method of producing white heart malleable iron.

Having established a scientific basis for the production of black heart malleable iron, the next logical step was to consider the advisability of using pig that had been smelted in anthracite or coke fired blast furnaces. Experiments were conducted with some of the best grades of pig iron in this classification. As I recall now two brands of iron from New Jersey, named respectively *Musconetoong* and *Secaucus* answered the purpose admirably. Later we made use of what was sold on the market as *off bessemer* pig iron.

Matter of Regret

In later years I have regretted that I did not claim the honor in the scientific world for this exceedingly important discovery. At the time it was made the company considered it too valuable a trade asset to be given publicity. A wide range of furnaces was available from which to select the pig iron, the cost was greatly below that of charcoal iron and definite results were assured where formerly malleable iron making was a hit or miss proposition.

In closing this brief recital I might add that in recent years Enrique Touceda, Richard Moldenke, H. A. Schwartz, Anson Hayes and others have corroborated fully my early conclusions and have set forth more elaborately the chemistry and metallurgy of modern black heart malleable iron castings.

Reviews Progress

(*Concluded from Page* 449)

plain them more satisfactorily. Some of the actual figures involved will be of interest. With the analysis previously given for high-test cast iron, tensile strengths around 60,000 pounds per square inch regularly have been attained. Transverse strengths almost double the ordinary with more than double the deflection are claimed. The addition of nickel, chromium, etc., has added another notch to these values, 65,000 pounds per square inch and even more being claimed. It would appear that with our present day knowledge, cast iron can be made strong enough to recapture much of the market lost to the steel and the malleable castings, and the producer of iron castings should lose no time in taking advantage of this fact.

There is still another development in cast iron which should prove valuable to the foundryman. A considerable reduction in the silicon and manganese content of cast irons, leaving the other elements as given in the previous typical iron, with high superheat when poured into castings gives a class of cast iron not quite as strong as those previously mentioned, but peculiarly amenable to an annealing process which converts the comparatively higher combined carbon contained to the temper-carbon variety without special interference by the finely crystalline graphite present. Thus, a fine-grained gray cast iron can be sent partly on the way of the malleable casting. Light castings with around 1.50 per cent silicon with over half their carbon as fine graphite, and low manganese, can be twisted readily. In other words, the material has malleability and can be elongated. Large and heavy castings practically anneal themselves, since only a few hours at 1550 degrees Fahr. are required to accomplish the combined carbon conversion. Thus is another avenue opened to the gray iron founder to retrieve his losses.

Standardized Specifications Are Urged for Refractories

THAT great strides can be made in the betterment of refractories through the adoption of some sort of standardized specifications for certain classes of work, seemed to be the concensus of opinion at the third annual meeting of the American Refractories institute, held May 8 and 9, at White Sulphur Springs, W. Va. It was not possible to adopt anything in the way of specifications at this meeting because so few were in attendance and the matter is to be held open for further discussion at future gatherings.

The most important business session of the convention was devoted to a symposium on specifications in which the following participated: Dr. F. A. Harvey, Harbison-Walker Refractories Co., Pittsburgh; S. M. Kier, Kier Fire Brick Co., Pittsburgh; Foster Holmes, Evans & Howard Fire Brick Co., St. Louis; C. E. Bales, Ironton Fire Brick Co., Ironton, O., and M. C. Booze, Charles Taylor Sons Co., Cincinnati. Morgan B. Smith, General Motors Corp., and W. A. Carter, Detroit-Edison Co., represented the consumers' side of the question taking a lively part in the discussion. S. M. Phelps of the Mellon Institute of Industrial Research, Pittsburgh, recommended certain changes, which now are being perfected.

President J. M. McKinley, who was re-elected for another term recited at length the achievements made in the improvement of refractory materials during the past year and outlined some of the plans and ideas in the minds of those prominent in the industry which are to be worked out during the coming 12 months.

A complete explanation of the different methods used in the "Screening of Fire Clays" was given by W. W. McKee, Link-Belt Co., Philadelphia. Mr. McKee fully described not only his own company's equipment but the machinery of other builders as well.

General Freight Agent William Fitzgerald of the Chesapeake & Ohio railroad whose subject was "Freight Rates on Basic Commodities," gave a great many cost statistics in explaining why at times it is necessary for the railroads to charge what appear to be prohibitively high freight rates.

New Officers

AMERICAN REFRACTORIES INSTITUTE

President

*J. M. McKinley
Vice president and general manager, Crescent Refractories Co., Curwensville, Pa.

Vice President

R. M. Sievers
Vice president and general sales manager, Evans & Howard Fire Brick Co., St. Louis.

Second Vice President

W. B. Coullie
Assistant general sales manager, Harbison-Walker Refractories Co., Pittsburgh.

Treasurer

*C. C. Edmunds
Treasurer, McLain Fire Brick Co., Pittsburgh.

Secretary

*Dorothy A. Texter
2202 Oliver building, Pittsburgh.

*Re-elected.

A recent report states that a consignment of 1500 tons of English hematite pig iron which corresponds to domestic low-phosphorus pig iron is being shipped directly to a Great Lakes port from Europe. The vessel will come down the St. Lawrence river, through the Welland canal, down the lakes and the iron will be unloaded on the dock at Milwaukee, its destination.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶More Talk Required

SEVERAL years ago a movement was started for the purpose of exchanging technical papers between the various foundrymen's associations in this country and in Europe. Each year since that time three prominent European foundrymen, one from England, one from Belgium and one from France, have prepared papers and in several instances have presented them in person before conventions of the American Foundrymen's association. The latter association has reciprocated in like manner. Members have prepared papers and in several instances have gone abroad to deliver them in person. Technical papers of any kind involve considerable work in preparation.

SOME of these papers have been frankly descriptive and contained no controversial points over which a discussion might be started. Others have dealt with purely theoretical subjects, or with points within disputable ranges in metallurgy and shop practice. With one or two exceptions the reception of these papers has been disappointing to the authors and to many in the audience who depend on a full and free discussion to clear up many points with which they are not familiar. Under ordinary conditions courtesy holds criticism in restraint, but that excuse does not hold where a paper is prepared intentionally to provoke discussion.

MODERN hurry-up methods may be partly responsible. The desire to crowd everything into as short a period as possible results in a program of a large number of papers scheduled for presentation in a woefully inadequate period of time. Obviously, it is impossible to do justice to any paper when the collection is presented at the rate of four for each 2-hour session. The motive underlying the annual paper exchange movement is highly commendable, but the value of this procedure can be greatly enhanced if a lively and more active interest is taken by the audiences where these papers are presented for discussion and comment.

¶One Good Job—Well Done

GRAY iron foundrymen of the present generation no doubt, in their early days, learned well the aphorism, "If you want a job well done—do it yourself." One can imagine them bent over their scarred and ink-stained school desks when they were small boys, manfully tracing these words in their spencerian copy books before the idea of castings, their production, use and sale ever entered their young heads. Such an assumption seems warranted in view of the splendid manner in which the Gray Iron institute set up its organization at Philadelphia on Friday, May 18.

THE meeting, which is reported on another page of this issue, was remarkable for the enthusiasm with which the gray iron foundry interests there represented took hold of their problems and sought their answers without thought of selfish interest. The organization committee, which has completed a formidable task since the conference in Pittsburgh, March 13, presented a working plan which was adopted in every particular by vote of the members present in Philadelphia. Many of this organization committee were continued as the first board of directors until the annual meeting that will be called in the fall of 1928.

THE primary task of the Gray Iron institute at present is an employment problem. The executive committee of the board of directors is charged with the task of securing a secretary-manager possessing unusual qualities of leadership, administrative ability, business foresight and good common horse sense. Thought and opinion, as crystallized to date, has diagnosed many of the ills of the gray iron foundry business that require treatment. The remedies are at hand, although many of them are slow acting medicines that will require a long period of time before they take effect. THE FOUNDRY has faith in the recuperative powers of the patient and extends its best wishes for an early convalescence and an ultimate full and vigorous recovery.

Trade Trends in Tabloid

WITH building awards reported in April as the highest in history, with automobile production stepped up during the same month, with continued high rates of production in the steel industry, the expectations for business in the late spring are favorable. Jobbing foundry business through the eastern and midwestern section is good, according to individual reports. In Ohio, according to A. J. Tuscany, secretary-manager, Ohio State Foundrymen's association, operations of member foundries were at 108 per cent of normal, during April, compared with 110 per cent for the preceding month. Car awards still are discouragingly small. April with 5783 ranks the second highest month in 1928. In consequence, railway steel castings plants and certain units of the malleable iron industry are not as active as might be. Slight advances in cast iron pipe prices are encouraging, but demand is not brisk. Deliveries can be made on standard sizes from stock. The employment situation has eased throughout the country and improvement has been most marked in Detroit, Cleveland, Chicago and other middle western centers. Industrial profits are improved for the first quarter of the year. The agricultural outlook is good and is reflected by optimistic forecasts of activity in implement and other farm machinery lines. Nonferrous operations continue fair.

RAW MATERIAL PRICES
May 24, 1928

Iron

No. 2 foundry, Valley	$17.00 to 17.25
No. 2 southern, Birmingham	16.00
No. 2 foundry, Chicago	18.00
No. 2 foundry, Philadelphia	20.76
No. 2 foundry, Buffalo	17.00
Basic, Valley	16.25 to 16.50
Basic, Buffalo	17.00
Malleable, Chicago	18.00
Malleable, Buffalo	17.50

Coke

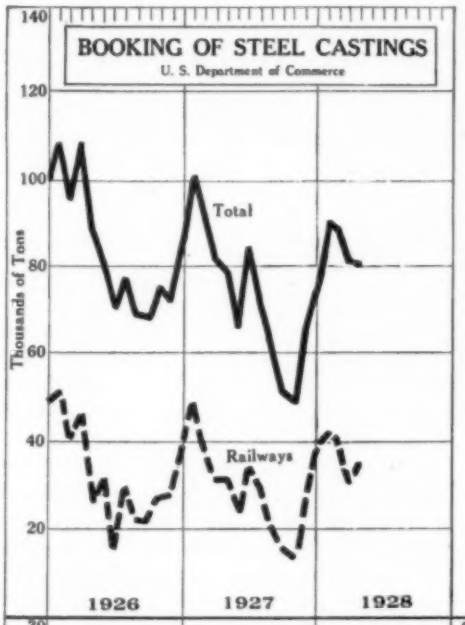
Connellsville foundry coke	$3.50 to 4.25
Wise county foundry coke	4.00 to 5.00

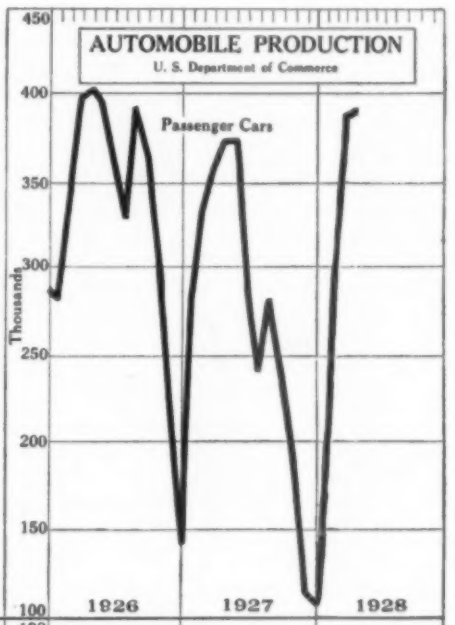
Scrap

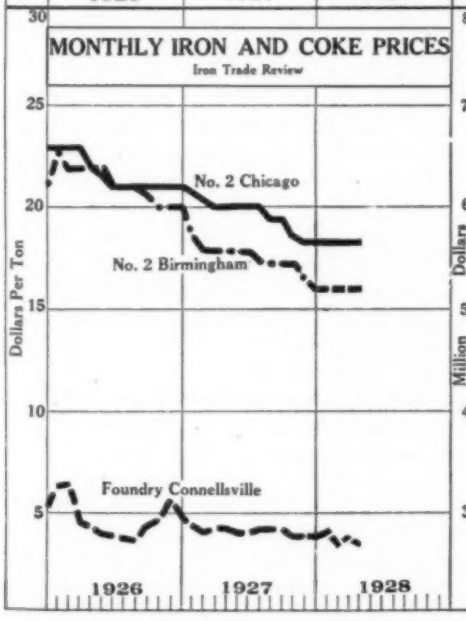
Heavy melting steel, Valley	$14.25 to 14.75
Heavy melting steel, Pitts	14.50 to 15.00
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Buffalo	12.75 to 13.25
Stove plate, Chicago	11.50 to 12.00
No. 1 cast, New York	13.00 to 13.50
No. 1 cast, Chicago	14.25 to 14.75
No. 1 cast, Philadelphia	16.00 to 16.50
No. 1 cast, Pittsburgh	14.75
No. 1 cast, Birmingham	14.00 to 14.50
Car wheels, iron, Pittsburgh	14.50 to 15.00
Car wheels, iron, Chicago	13.50 to 14.00
Railroad malleable, Chicago	13.00 to 13.50
Agricultural Mal., Chicago	11.75 to 12.25
Malleable, Buffalo	15.00 to 15.50
Railroad malleable, Pitts	15.00 to 15.50

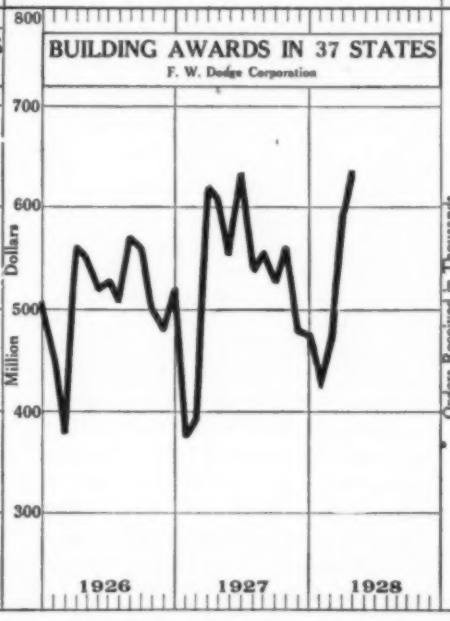
Nonferrous Metals

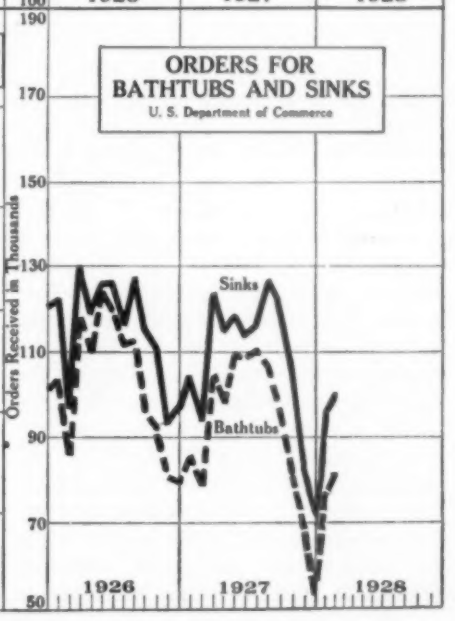
	Cents per pound
Casting copper, refinery	14.25
Electro copper, producers	14.62½
Straits tin	51.62½
Lead, New York	6.10
Antimony, New York	11.00
Nickel, electro	37.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	16.50 to 17.00
Zinc, East St. Louis, Ill.	6.12½ to 6.15











Personal

Charles L. Jobb for several years vice president and general manager Canada Iron Foundries Ltd., Montreal, has been appointed president to succeed the late Major Vincent J. Hughes. Mr. Jobb also is president and director of Paper Machinery Ltd., Montreal, and Port Hope Sanitary Mfg. Co., Port Hope, Ont. He was born in Londonderry, N. S., in 1876, and began his business career with the Londonderry Iron & Mining Co. He spent some time with the William Glendenning Foundry Co., Montreal, and then returned to Londonderry as superintendent of foundries. Later he was appointed general superintendent of the various foundries operated by the company in Montreal and Three Rivers, Que.

M. J. Carroll, for several years foreman in the iron roll foundry of the Hubbard Steel Foundry Co., East Chicago, Ind., has been appointed general foundry foreman by the Pettigrew Foundry Co., Harvey, Ill.

E. A. Custer Jr. Philadelphia, described the ideal foundry of the future to the engineering class of the University of Pennsylvania on the afternoon of May 15. He claimed that the trend of the times points steadily toward radical changes in the manner of making castings.

O. S. Sleeper, for the past seven years associated with the O. S. Sleeper Co., has been appointed engineer in charge of special development work by the Buffalo Foundry & Machine Co., Buffalo. Mr. Sleeper is an authority on vacuum dryers and chemical plant equipment. Prior to his association with the O. S. Sleeper Co., he was engineer in charge of all engineering for the Buffalo company for 15 years.

Czecho-Slovakians Hold Foundry Meeting

The annual general meeting of the Czecho-Slovak Foundrymen's association was held at Moravska Ostrava from May 10 to 13. Ing. J. Trnovsky, director, Iron and Steel Works, Witkowitz, presided. At the general meeting on Sunday, May 13, Professor Dr. Mont. Fr. Pisek, president of the association, delivered an address, which was followed by a lecture by Ing. A. Strohmer on "Methods of Coal Mining in the Moravska Ostrava-Karvinna District." A business meeting of the association followed. A series of visits were made to industrial plants in the vicinity, including a visit to the coke ovens at the Frantisek colliery, to the colleries of Banska horni a hutni, and to a colliery operated by the Northern Railway Co. On May 12 the delegates visited the Iron and Steel Works, Witkowitz.

Rejoins Organization

Claude B. Schneible, a member of the sales organization, American Foundry Equipment Co., Mishawaka, Ind., during 1919 to 1924, has returned to the firm as factory representative after an absence spent in engineering research in the chemical, oil and gas industries. Mr. Schneible

CLAUDE B. SCHNEIBLE

was born in New York city in 1891, and after receiving an engineering education at Northwestern university, Chicago, entered the employ of the Mott Sand Blast Mfg. Co., Chicago. He held several plant positions with this firm and then joined the American Foundry Equipment Co. in 1919. Mr. Schneible also is a member of Joseph Schneible Sons Inc., Chicago, manufacturer of chemical equipment. He has contributed a number of inventions in chemical distillation processes and in sandblast engineering.

Meeting Was Held

The final meeting of the 1927-28 season of the Quad-City Foundrymen's association was held on May 28 at the Davenport, Ill., chamber of commerce. W. D. Moore and J. T. MacKenzie, both of the American Cast Iron Pipe & Foundry Co., Birmingham, Ala., spoke on centrifugal casting of cast iron pipe.

Form Sales Company

Recently through an arrangement between the United Industrial Engineering Co., Cleveland, and the Trumbull Mfg. Co., Warren, O., a subsidiary selling corporation to be known as the Gaskill Furnace Corp., has been formed. This firm will sell furnaces used for melting nonferrous metals, annealing, heat treating, forging and rivet heating which are manufactured by the Trumbull Mfg. Co. Officers of the Gaskill Furnace Corp. are James A. Gaskill, president; M. L. Derge, vice president and general manager, and E. A. Williams, secretary-treasurer.

Is New Branch Manager

H. O. Coe recently has been appointed manager of the Cleveland branch office of the United States Electrical Tool Co., Cincinnati. Mr. Coe was in the sales division of W. Bingham Co., Cleveland, for eight years and for six years previous to this was engaged in the retail hardware business under the name of Coe & Bacher. Mr. Coe's headquarters will be at 403 Erie building, Cleveland.

Stress Use of Castings

At the recent convention of the American Foundrymen's association which was held in Philadelphia, the Milwaukee Foundry Equipment Co., Milwaukee, distributed a booklet entitled, "Would a Casting Be Better?", to call the attention of foundrymen and others to the value of castings, and to create a castings consciousness. The booklet contains information showing the superiority of castings over other types of materials. Several illustrations depict the use of cast iron in ornamental work.

A Correction

Through a regrettable error the picture of J. W. Oliver, Standard Sanitary Mfg. Co., Pittsburgh, was omitted from the *Family Photograph Album* of May 15 and in its place is shown the likeness of W. E. Sloan, president of the Sloan Valve Co., Chicago. THE FOUNDRY regrets this mistake and any embarassment which it has caused to either of these gentlemen. Both likenesses with the correct titles will appear in forthcoming copies of the Album.

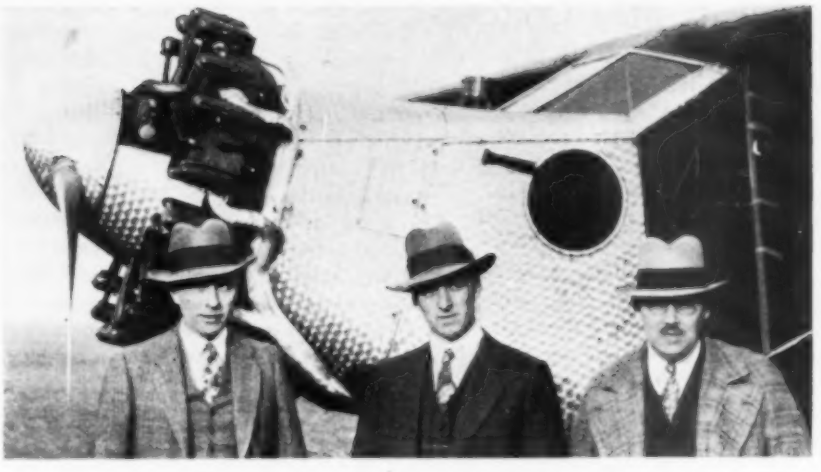
J. R. Eckley now is associated with the Pittsburgh sales office of the Aluminum Co. of America, 2400 Oliver building, Pittsburgh.

Form Steel Bureau

The Steel Castings Development bureau has been organized with headquarters at room 500, Stock Exchange building, Philadelphia, to conduct research and development work in steel castings and to acquaint all possible users of this product with its general qualifications and its usefulness for specific purposes. George Batty has been appointed research director. Mr. Batty has been a consulting engineer in the steel castings industry, both in this country and in England. Prior to his appointment as research director of the newly organized bureau he had been connected particularly in a consulting capacity with the Detroit Steel Casting Co., Detroit.

J. V. McCrea has been appointed by the Steel Castings Development bureau to serve as research associate on steel castings problems with the United States bureau of Standards, Washington. Mr. McCrea has been working for the past six months with the bureau of mines and prior to that had been metallurgist with the Dodge Steel Co., Philadelphia, for over two years.

Nine companies comprise the membership of the Steel Castings Development bureau. They are the Dodge Steel Co., Philadelphia; Crucible Steel Casting Co., Lansdowne, Pa.; Riverside Steel Casting Co., Newark, N. J.; Atlantic Steel Castings Co., Chester, Pa.; Deemer Steel Casting Co., New Castle, Del.; Empire Steel Casting Co., Reading, Pa.; Pennsylvania Electric Steel Casting Co., Hamburg, Pa.; the Eagan-Johnson Steel & Iron Co., Crum Lynne, Pa., and the Treadwell Engineering Co., Easton, Pa.



TRANSPORTATION HAS CHANGED SINCE 1896

E. O. Beardsley and W. F. Piper, Beardsley & Piper Co., Chicago, and their advertising manager, L. W. Kreiker, went to the Philadelphia convention in their airplane. The trip from Chicago took 8 hours and 8 minutes, including a 42-minute stop in Cleveland

Will Sail for Far East

Hans J. Meyer, who recently was appointed as an engineer of the foreign department, International Combustion Engineering Corp., New York, will sail for the Far East on June 6. Mr. Meyer's early training was with the Milwaukee Electric Railway & Light Co., Milwaukee. Later he was district engineer for the Allis Chalmers Mfg. Co., Milwaukee; sales engineer, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; superintendent, Shreveport Gas, Electric Light & Power Co., Shreveport, La.; a partner of Vaughn, Meyer & Sweet, consulting engineer, Milwaukee, and a partner in the firm of Charles L. Pillsbury Co., consulting engineer, Minneapolis. During the war Mr. Meyer was appointed administrative engineer, United States fuel administration, bureau of conservation, Washington. He became identified with the Combustion Engineering Corp. in 1926 and was placed in charge of design and construction of complete fuel burning and steam generating equipment for the Kip's Bay station, New York Steam Corp.

Talks on Cores

J. A. Gitzen, with the Lindsay-McMillan Co., Milwaukee, addressed the members of the Wisconsin Gray Iron Research group at a meeting held in the Republican house, Milwaukee, Wednesday evening, May 2. The subject of Mr. Gitzen's talk was "Cores, Core Sand and Core Binders."

Daily Foundry Carries Convention News

ON Monday, Tuesday, Wednesday and Thursday of the convention, a daily edition of THE FOUNDRY *was published and distributed. This paper represented an unusual undertaking in remote control publishing, since the material was written in Philadelphia by men from the Cleveland and New York offices of the Penton Publishing Co., and sent to Cleveland by special delivery mail, telegraph, telephone, and telephoto. A staff of editors, artists and makeup men assembled each day's paper and started it on the night journey to Philadelphia.*

A photograph of the official opening appeared on the first page of the Tuesday issue of The Foundry Daily. Due to the fact that the paper was printed in Cleveland, unusual speed in handling was necessary to assure its appearance at that time. Two photographers engaged by THE FOUNDRY, *through the courtesy of the Philadelphia Public Ledger took the flashlight picture. This was rushed through the necessary processes and a print secured in 20 minutes.*

This print then was taken by the next available train to New York, in care of one of the editors of THE FOUNDRY. *He supervised its delivery to the telephoto division of the American Telephone & Telegraph Co., in New York, where the print was rephotographed and then transmitted over the telephone wires to the telephoto office in Cleveland. Here a messenger from the office of* THE FOUNDRY *awaited its arrival in the form of a negative which was rushed through to a print that was delivered in person to the Mugler Engraving Co. The latter advised in advance had the necessary men at hand to rush this print through the engraving processes to produce the cut from which the photograph was presented in The Foundry Daily.*

Presents May Lecture

The May lecture of the British Institute was delivered in London on May 8 by Prof. Cecil H. Desch, of the University of Sheffield, Sheffield, England, who chose for his subject "The Chemical Properties of Crystals." Dr. Walter Rosenhain, president of the institute, was in the chair.

Professor Desch, after referring to the light thrown on the mechanical and physical properties of crystals by modern ideas as to the atomic structure of matter and the internal structure of the atom, discussed the various ways in which atoms may be held together in a crystal. When a metal is attacked by an acid, the surface is not dissolved uniformily, but distinct etch-figures are produced, and the shape of these must be intimately related to the internal structure of the metal crystals. The figures may vary in the most curious way when the solvent is changed, and that is shown most clearly by large single crystals of copper. The chemical properties of crystals are illustrated most easily by substances which do not consist of closely packed atoms, but have an open structure, such as graphite. Looseness of structure also is important for diffusion in solids, on which many technical processes depend.

F. P. Walsh has been appointed manager of the crane department and R. H. Moore has been made manager of the foundry equipment department of the Whiting Corp., Harvey, Ill.

Form Brass Association

Recently a group of brass foundrymen and others interested in the casting of brass and nonferrous metals formed the Associated Brass Founders of New England with headquarters in Boston. Justice A. Duncan, William Duncan & Sons Foundry Co., East Boston, Mass., is president of the new association and L. P. Robinson, New England manager, Werner G. Smith Co., Boston, is secretary. The association meets on the fourth Wednesday of each month at the Engineers' club, Boston, and its purpose is to promote better understanding and co-operation among the members. At the present time the association has launched a program of uniform cost accounting.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

The Dover, N. J. plant of the Richardson & Boynton Co. recently was placed in operation.

Jensen Foundry Co., Romeo, Mich., has been incorporated with $50,000 capital to operate a general foundry.

Starke Foundry & Mfg. Co., Richmond, Va., has been incorporated with $25,000 capital by Allen J. Saville, Electric building.

Davis & Furber Machine Co., North Andover, Mass., has work started on a 2-story foundry addition, 30 x 50 feet.

Art Metal Works Inc., Newark, N. J., has been incorporated with 190,000 shares no par value stock to manufacture ecclesiastical metal statuary, by McCorter & English, Newark attorneys.

Black Hawk Brass & Aluminum Foundry, Westfield avenue, Waterloo, Iowa, newly organized by E. E. and C. P. Foster, will engage in brass, aluminum and bronze foundry work.

Cocker Machine & Foundry Co., Gastonia, N. C., iron foundry and machinery manufacturer, has awarded the contract for two plant additions. (Noted May 15.)

Babbitt Machine Co., Portland, Me., has been incorporated with $100,000 capital to manufacture castings and tools by Charles E. Babbitt, South Portland.

Western Foundry & Furnace Co., Tacoma, Wash., has increased its capital stock from $99,000 to $199,000 and has changed its name to Western Furnaces, Inc.

W. R. Risk, Brooksville, Fla., city clerk, and associates contemplate establishing a foundry for the manufacture of aluminum emblems for automobiles, etc.

Excelsior Stove & Mfg. Co., 510 South Front street, Quincy, Ill., has awarded the contract for a plant and warehouse to Buerkin & Buerkin, 201 Broadway.

J. B. Hardison is negotiating with the city to establish a stove foundry at Columbia, Tenn. It is dependent on the city providing a building 70 x 320 feet and eight acres of land.

Reading Casting Co. Inc., Monocacy, Pa., has been incorporated with $125,000 capital to carry on a general foundry and machine shop business by H. Claude Bell, 941 Fourth street, Reading, Pa.

Wilder-Strong Implement Co., Monroe, Mich., has started manufacturing in temporary buildings, following a loss sustained to its plant by a recent fire. Work on rebuilding the plant will start immediately.

East St. Louis Casting Co., East St. Louis, Ill., has developed a new furnace and contemplates expansion. It is seeking a 15-acre site in East St. Louis for its extension program. Ralph Hill is president of the company.

Alfred Bahr, W. Ball and J. J. Boring, owners of a foundry being established at Garrett, Ind., have work nearing completion on the foundry building, 40 x 60 feet. Most of the machinery is in place. (Noted May 15.)

Blackhawk Foundry & Machine Co., 325 Clark street, Davenport, Iowa, has awarded the contract for a foundry building 42 x 90 feet to the Priester Construction Co. Handling equipment will be installed in this building. Work is expected to start immediately.

National Pattern Works, Cleveland, has moved its works to 8713 Cedar avenue. In addition to the manufacture of wood patterns the company now is operating a small foundry for the production of white metal patterns for match plates. J. G. Eierman is owner.

Barnes Foundry Co., Cleveland, manufacturer of wood and metal patterns and brass, bronze and aluminum castings, has moved from its former location at 3181 West 104th street to the plant of the Pattern Engineering Co., 4007 Detroit avenue, which it has bought.

Commander Furnace & Foundry Co., Niantic, Ill., has been incorporated with $400,000 in preferred shares and $45,000 in common shares to manufacture and deal in all types of warm air heating systems and hot water and steam systems by V. O. Jones, W. C. Jones and J. T. Groves.

Ross-Meehan Foundries, Carter street, Chattanoogn, Tenn., have leased the Gustafson Mfg. Co., Twenty-sixth and Chestnut streets, and will operate the business as unit No. 7. F. E. Spencer is in charge of the unit. No plans have been made as yet for enlarging the manufacturing facilities.

Wilson Foundry & Machine Co., Pontiac, Mich., plans an expansion program for its plant to consist mainly of the installation of additional machinery and equipment.

Simon Scullin, Philadelphia, has awarded the contract for rebuilding that part of his iron foundry damaged in a recent fire to Knox Landers Co., 1132 Vine street. (Noted May 15.)

Announcement is made that the name of the Dempsey Foundry on North Water avenue, Sharon, Pa., has been changed to the Shenango Foundry. John Sheridan has been named superintendent, new electric equipment has been installed and the cupola overhauled. The foundry specializes in blast furnace and rolling mill equipment.

University of Arkansas, college of engineering, Fayetteville, Ark., W. N. Gladson, dean, plans to rebuild its shops which were burned in a fire May 4. Two buildings, one about 32 x 200 feet, will house the machine shop and pattern shop and the other 32 x 160 feet will house the blacksmith shop and foundry. Upon completion of the buildings, the engineering department will be in the market for full shop equipment, including machine tools, etc.

Ohio Steel Foundry Co., Lima, O., has let a contract for a foundry unit, which with equipment will cost $75,000, to the H. K. Ferguson Co., Cleveland. Additional equipment for the manufacture of locomotive castings and other heavy steel products will be provided in the new building, which will be 53 feet wide, 253 feet long and 35 feet high. A 10-ton bridge crane and a jib crane of similar size will be installed. J. E. Galvin is president of the foundry company, which also has branch units at Springfield and Bucyrus, Ohio.

Incorporation of the Chisholm-Moore Malleable Iron Co., Cleveland, as the second step in the reorganization of the old Chisholm-Moore Manufacturing Co., founded in 1897 by Edward Y. Moore was announced recently. The new company was incorporated to conduct the malleable iron casting business recently separated from the chain hoist and crane manufacturing departments by a merger with the Columbus-McKinnon Chain Co. of Tonawanda, N. Y., and as a holding company for the lands and building at 5046 Lakeside avenue northeast, to be occupied by both companies, Johnson said. J. H. Redhead, formerly of Columbus, is to be president and treasurer of the Chisholm-Moore Malleable Iron Co. and A. H. Chappelka, vice president of the old company, is to hold the same office in the new. Samuel H. Moore, son of the founder, and retiring president, is to be a director of both companies.